UNIVERSITÀ DEGLI STUDI
DI SALERNO

DISES Dipartimento di Scienze Economiche e Statistiche

PhD in

ECONOMICS AND POLICY OF MARKETS AND FIRMS

Marketing Management

XXXV ciclo

Thesis

# TOWARD THE FUTURE COMMUNITY CARE: A MULTI-STEP EXPLORATORY STUDY FROM A SERVICE & SYSTEMS PERSPECTIVE FOCUSED ON THE KEY ROLE OF TECHNOLOGY


*PhD Coordinator*

*Prof. Alessandra Amendola*

*PhD Student*

*Dr. Claudia Perillo*

*Supervisor*

*Prof. Marialuisa Saviano*


a.a. 2021/22

A mio fratello Francesco

A nonno Gigi e a nonno Franco

"Studying, and striving for truth and beauty in general, is a sphere in which we are allowed to be children throughout life".

*"Lo studio e, in generale, la ricerca della verità e della bellezza sono una sfera di attività nella quale ci è consentito di rimanere bambini per tutta la vita".*

A.E.

Table of Contents

# INTRODUCTION

In our fast-changing world, marketing and management acquire a strategic relevance. They become a means to an end when it comes to making healthcare more effective, efficient, and sustainable. A key role in achieving these goals is played by a systems organization of healthcare (Pollard, 2016), hence, by the adoption of a systems approach.

Due to the aging of the population and the growing number of chronical illnesses and rare diseases, the long-term care need is increasing. This situation highlights the need to define governance policies capable of ensuring the sustainable development of the economic and social system through forms of integration, taking also into account that integration should be an organizational/managerial philosophy (Siano et *al.,* 2013; Siano et *al.*, 2018).

In this problematic context, a need to observe and to interpret complex service systems and social phenomena using general schemes of interpretation arises (Saviano, Bassano, & Calabrese, 2010). Essentially, it is increasingly required to balance effectiveness, efficiency and sustainability in healthcare system governance (Saviano, Bassano, & Calabrese, 2010). In particular, there is a focus is on local Italian healthcare systems which are analysed in their complexity through the lens of the viable systems approach and service science conceptual frameworks.

Given also Covid-19 pandemic evidence and the guidelines of the National Plan of Recovery and Resilience, this work aims to investigate which are the conditions to pursue the necessary evolution of healthcare toward community care from a service and systems perspective.

On the base of this premise, more specifically, this work starts investigating the conditions of the effectiveness, efficiency, sustainability, and safety of healthcare services while shifting from the hospital- based setting toward the community and homecare one.

The work starts with an overview on the INHS and on community and home care. In the first chapter, the state of the art is therefore outlined to gain a better understanding of the phenomenon, comparing the two models, the hospital based and the community based, in the light of Covid-19 pandemics and given the areas of action of the PNRR.

In the second chapter, the multistep interpretative methodology is illustrated. The aim of this chapter is to design the conceptual model that allows us to run the further empirical analysis. The lenses come from a framework that synthetize the Viable Systems Approach, Service Science and Service Dominant Logic. In this chapter is also provided a Service Science

reference model. Then the methodology used for the following steps (and chapters) is presented. In the light of the designed conceptual framework, a more focused literature review is conducted about the discovered critical factors.

In the third chapter first interpretative hypotheses are developed, starting from the comparison of the two provision models in the light of the VSA structure/system framework. The complexity of reconciling effectiveness, efficiency, sustainability, and safety of healthcare services is analysed in a systems perspective. A revised system's view of the LEAs framework is proposed, also. Thus, it is possible to analyse the possible shift from hospital to community and home care, which is investigated also in relation to the reference model of the Bolton cube to understand how the different dimensions of healthcare services change when this transition happens. The evolution toward community and home care is characterized by a higher social presence in the service provision, that could increase the level of complexity to manage. Thus, the question is how it is possible to manage this increased social presence, and thus complexity, while addressing effective, efficient, sustainable, and safe proximity and community healthcare? A possible answer, suggested by the service science three-dimensional framework, deals with leveraging on the digital density of the service. This brings out the specific problem: the critical role of technology in the path toward a higher digital density of healthcare.

In the fourth chapter the step 2 of the methodology is run. Mapping the literature review aims to develop interpretative hypotheses about the critical role of technology acceptance in the path toward a higher digital density of the healthcare services. The methodology of the bibliometric literature review through VOSviewer software is presented, and the three levels of analysis defined: an overview on teleassistance as an evolutive trend of healthcare, a focus on telerehabilitation as a community-based service, and a review of technology acceptance theory in healthcare as the key specific problem to address. The main theoretical findings of the chapter id the need to investigate the technology acceptance problem in the imposed innovation of future community and home care in Italy.

In the fifth and final chapter, a qualitative approach is used for carrying out the explorative empirical case-based study. The aim is to find evidence from the analysis of a real problem through which the interpretative hypothesis previously derived from the state of the art and theoretical study can be developed to then discuss the key elements to designing an effective, efficient, and sustainable transition toward the future community and proximity-based healthcare.

# CHAPTER I – THE PROBLEMATIC CONTEXT UNDER FOCUS: RECONCILING THE EFFECTIVENESS, EFFICIENCY AND SUSTAINABILITY OF THE HEALTHCARE SERVICE IN ITALY

The premises of this work are the elderly of the population, the increasing incidence of chronic illnesses (whether it is one or there are comorbidities), the progressive cuts to the healthcare expenditure, together with the evidence coming from the Covid-19 experience and the consequently goals and lines of action defined in the National Recovery and Resilience Plan. The Italian Healthcare Service, indeed, is facing different challenges during is mandatory (and natural) process of evolution. An evolution affected by the very nature of the NHS, the differences in healthcare regional governance, the evidence of and the transformations due to Covid-19 experience, and, not least, affected by the challenges for the future necessary evolution of governance and by the guidelines and goals of the PNRR. In this chapter we present the general framework of the healthcare system in Italy, taking into account different governance models, the Covid-19 evidence and the PNRR in order to derive a first general research question that would address the following step of the research.

## 1.1 The Italian National Healthcare Service system

The Italian National Healthcare Service[1] was established in 1978 thanks to Law no. 833 and its foundational principles are the universality, equity, and solidarity of care. The INHS guarantees all Italian citizens universal access to healthcare services as per the Italian Constitution. Indeed, Article 32 of the Italian Constitution states, "*The Republic safeguards health as a fundamental right of the individual and as a collective interest and guarantees free medical care to the indigent. No one may be obliged to undergo any health treatment except under the provisions of the law. The law may not under any circumstances violate the limits imposed by respect for the human person"* (Senato della Repubblica, 1947).

[1] From now on INHS

Universality of care means that healthcare services are available to all citizens. In the light of the 1978 law, health is not only an asset for the individual but for the whole community. This principle is pursued through the promotion, maintenance, and recovery of physical and mental health. This is possible through a network of facilities distributed throughout the country.

The principle of equity means that all citizens are granted access to healthcare services without any type of discrimination, whether it be related to personal, economic, or social conditions.

The principle of solidarity is related to the same accessibility to the service in relation to the same needs. To pursue equity in healthcare provision, on the one hand, effectiveness, efficiency, compliance and transparency of the service provision must be guaranteed; on the other hand, healthcare professionals must clearly inform the citizen about the most suitable type of healthcare provision (i.e. informed consent).

In addition to these foundational principles, the INHS has defined organisational principles, which are as follows (Italian Ministry of Health, 2019):

- Placing the focus on the person: citizens can exercise a series of rights resulting in health actors' duties, such as freedom in choosing the place of care, the right to be aware of the illness and the treatment, the right to accept or object to the treatment (informed consent), the right of the patient to be taken in for care by doctors and other healthcare professionals, privacy rights, the IHNS has to place citizens' health before other choices (in light of available economic resources).
- Public responsibility while protecting the right to health: shared responsibility between the central State and the regions. The Italian Republic defines the essential levels of assistance, which will be further analysed and discussed. The regions have their own jurisdiction for planning and managing healthcare.
- Cooperation between different governance levels inside the IHNS: cooperation between central government, the regions, the local health authorities [2] and municipalities.
- Enhancement of the position and role of health professionals.
- The integration of health and social care, which will be further discussed.

These principles are effective for the achievement of the Italian NHS's ultimate aim, which is to prevent illness rather than having to treat it.

2 Also known as ASLs - Aziende Sanitarie Locali.

Prevention is at the core of the Italian NHS, indeed the Ministry of Health's name (Ministero della Salute) was updated in 2001 via Law no. 317 (previously it was known as the Ministry of Healthcare [Ministero della Sanità], meaning that the focus was on treating illnesses).

The Ministry of Health is the central body of the Italian NHS and its functions are:

- to protect human health,
- to protect animals health,
- to safeguard health in the workplace,
- food hygiene and safety,
- coordination of NHS activities.

Since the early 90s, the NHS has been undertaking a process of administrative reorganisation and cost containment, with the aim of reducing costs in the light of the increasing healthcare needs due to the ageing population and new technologies (Prante et al., 2020).

The stakeholders involved in guaranteeing this health are the central State and the regions, which take on the shared responsibility of providing healthcare services. The Italian Constitution defines how the legislative competence is distributed between central government and the regions (Article 117) and the distribution of administrative functions (Article 118) and financial resources (Article 119).

Thanks to the constitutional reform of 2001 (Prime Ministerial Decree of 29 November 2001), power and responsibilities were divvied up between central government and the regions. This distribution was defined to reverse the concentration of state power. This reform grants central government the exclusive power to set the so-called essential levels of assistance, while the regions have virtually exclusive powers over regulation, organisation, administration, and the funding of publicly financed healthcare (Torbica & Fattore, 2005).

The INHS is made up of a series of stakeholders and entities involved in the process of delivering healthcare services. The INHS consists of three levels:

- the central level - central government protects the health of citizens, draws up the National Health Plan (PNS) and defines the Essential Levels of Assistance (LEAs),
- the regional level - the regions ensure the LEAs, define the Regional Health Plan (PSR) and define the organisation and financing of Local Healthcare Authorities (ASLs) and Local Hospitals (AOLs),
- the local level - the Health Units provide the services (they are both the ASLs and AOLs).

The involved stakeholders at these levels are:

- Ministry of Health

- Supreme Health Council
    - National Institute of Health
    - National Agency for Regional Healthcare Services (Age.na.s)
    - Scientific Hospitalisation and Treatment Institutes (IRCCS)
    - Experimental Zooprophylactic Institutes (IIZZSS) on Public Health
    - Italian Medicines Agency (AIFA)
- Regional Healthcare Services
    - Regions and autonomous provinces;
    - Local Healthcare Authorities (ASLs) - in this case, the hospital is just one of the many healthcare facilities of the health unit, together with districts and clinics. The ASL has got a Managing Director, which is above the Healthcare Director and the Administrative Director of each facility;
    - Hospitals (AOs) - in this case, the Health Units coincide with the hospital itself. There is a Managing Director, a Healthcare Director and an Administrative Director.

The General Manager is appointed by the region. The GM should have a university degree (a degree in medicine is not mandatory) and he appoints the Healthcare Director and the Administrative Director.

A transition is taking place at the moment: some hospitals are changing their names to Local Healthcare Units (ASST - Aziende Socio Sanitarie Territoriali). Some ASLs, on the other hand, are changing their names to Healthcare Protection Agencies (ATS - Agenzie di Tutela della Salute).

Financing mechanisms are also quite different between hospitals and ASLs. While services are paid on the basis of DRGs (Diagnosis-related groups) at the hospitals, in ASLs the services are paid according to a global budget allocated to the ASL itself.

The DRG is a system in which patients discharged from hospitals are classified in groups according to the utilisation of resources during their period of hospitalisation. In this way, it is possible to account for the cost of each service (taking into account healthcare actors, resource usage, facilities usage and so on).

In recent years, the INHS has been facing a transformation towards a system or regional holding, made up of service providers (hospitals, private structures, etc.) and headed by a parent company (Longo & Ricci, 2019). Further to this, the parent company (ASL) has been acquiring a management role, defining strategic objectives, programmes and modelling the operative

procedures (Longo & Ricci, 2019). This is a consequence of the arising healthcare autonomy in the regions.

## 1.2 The Essential Levels of Care

In 2001, the essential levels of care were defined and then updated via the Prime Ministerial Decree of 12 January 2017. They are the core instrument to ensuring the right to healthcare and contain the list of services and benefits that the INHS is required to provide to all the citizens. These services could be free of charge for the citizen or charged upon payment of a participation fee (ticket).

The two main policy goals of LEAs are equality (guaranteeing access to care) and cost-containment.

An LEA monitoring system has also been established throughout the country, the responsibility of which is assigned to the first technical body established in 2002 made up of representatives from the Ministry of Health, the Treasury, and the regional governments. This body must monitor and evaluate the actual provision of services included in the list of LEAs and their costs. Subsequently, the National LEA Commission was established in 2004 in order to update the LEAs. This commission comprises 14 members: 6 experts in healthcare management, planning and organisational sciences are nominated by the Ministry of Health, 7 are regional representatives, and one is appointed by the Treasury (Torbica & Fattore, 2005).

The new list of LEAs was published in 2017 through the Prime Ministerial Decree of 12 January 2017, which fully replaces the previous one from 2001. The Prime Ministerial Decree of 12 January 2017:

- defines the activities, services and benefits guaranteed to citizens with the public resources made available by the INHS;
- describes the services and activities already included in the essential levels of care with greater detail and precision;
- redefines and updates the lists of rare diseases and chronic and disabling diseases that give the right to exemption from the participation fee;
- updates the tariff lists of the outpatient specialist and prosthetic assistance, introducing technologically advanced services and excluding obsolete services.

The positive list of services categorises the provided services into three macrolevels of care (Ministry of Health, 2019):

- public health services aimed at collective prevention and public health:

    - the monitoring, prevention and control of infectious and parasitic diseases, including vaccination programmes;
    - the protection of the health and safety of open and confined environments;
    - the monitoring, prevention and protection of health and safety in the workplace;
    - animal health and veterinary urban hygiene;
    - food safety - consumer health protection;
    - chronic disease surveillance and prevention, including promoting healthy lifestyles and organised screening programmes; nutritional monitoring and prevention;
    - legal-medical actions for public purposes.
- community care, dealing with healthcare services and health and social services distributed throughout Italy:
    - basic health care;
    - local health emergency service;
    - pharmaceutical assistance;
    - additional assistance;
    - outpatient specialist assistance;
    - prosthetic assistance;
    - spa assistance;
    - home and local healthcare assistance;
    - residential and semi-residential healthcare assistance.
- hospital care:
    - emergency department;
    - ordinary hospitalisation for acute cases;
    - day surgery;
    - day hospital;
    - post-acute rehabilitation and long-term care;
    - transfusion activities;
    - cell, organ and tissue transplant activity;
    - poison control centres (also known as CAVs).

Regions are able to guarantee services and benefits beyond LEAs on the basis of their own economic resources.

With the Decree of 21 November 2005, the Permanent Committee for the assessment of the provision of LEAs has been established at the Ministry of Health. This Committee is tasked with assessing how LEAs operate in terms of effectiveness, efficiency and compliance.

### *1.2.1 Collective prevention and public health*

The first macro-level of the LEAs deals with public health services, which include activities and benefits aimed at protecting the health and safety of the community from infectious, environmental, work and lifestyle risks.

As previously stated, the areas of activities provided free of charge are:

- the monitoring, prevention and control of infectious and parasitic diseases, including vaccination programs;
- the protection of the health and safety of open and confined environments;
- the monitoring, prevention and protection of health and safety in the workplace;
- animal health and veterinary urban hygiene;
- food safety - consumer health protection;
- chronic disease surveillance and prevention, including promoting healthy lifestyles and organised screening programs; nutritional monitoring and prevention;
- legal-medical actions for public purposes.

The services excluded from this level are the activities involving individual preventative care, except the vaccination campaign and the oncological screening activities organized by the INHS.

There are 10 mandatory vaccinations for children from birth to sixteen years of age. These vaccinations are free of charge and are delivered through the ASLs according to the vaccination calendar. Vaccination is mandatory in order to register children at nursery. For primary school, children are not obliged to get vaccinated, but the school will notify the ASL if there are any children without the vaccine.

Other free of charge vaccinations are, for example, the flu vaccine and the HPV vaccine, which are not mandatory.

As regards oncological preventative screening, the active programmes are:

- breast cancer screening, for women aged between 50 and 69 years old. The screening is performed every 2 years;
- cervical cancer screening, for women aged between 25 and 64 years old. The Pap-test is performed every three years. Recently the Ministry of Health suggested that regions

should also perform HPV test (for women aged at least 30 years old to be performed every 5 years) as cervical cancer screening;

- colorectal cancer screening, for patients aged between 50 and 69 years old, the test is performed every 2 years (some regions have got a different preventative care programme according to which the screening is performed just once at the age of 58/60).

Patients eligible for the screening, according to regional policy, will receive the invitation for the tests.

The new LEAs also determine neonatal screening for congenital diseases. The test is performed between 48 and 72 hours after the birth at the birthing centre before the baby is discharged.

Any service provided by healthcare facilities which deals with the patient's private interest is ruled out, with patients being able to access the service by paying a fee.

On the other hand, there are services included in this macro-level which can be provided by paying a partial fee (ticket).

### *1.2.2 Community care*

The main characteristic of community care is that it is delivered on a locally (not at the hospital but at healthcare facilities across the country), inside districts. Districts are part of the ASL and are in charge of managing local healthcare services. The district has the autonomy to manage resources and is led by a District Director.

Community care services are:

- basic health care - the INHS guarantees patients' literacy, it aims to raise awareness of healthy lifestyles, it informs citizens about healthcare services, it guarantees a GP for each citizen, it provides services for preventative care and for treatments.
- continuity of care during the night and on bank holidays and the evenings prior to bank holidays;
- local health emergency service - which is a competence of the regions. The 118 service is available 24/7 and aims to organise and manage emergency services. In many regions the '112 unified emergency number' (NUE) is activated to manage emergency calls. The emergency network is made up of the 118 operation centres, the local facilities

(one for every 60.000 citizens covering a maximum radius of 350 square kilometres) and the Emergency Medical Service (HEMS);

- pharmaceutical assistance, which is provided through affiliated pharmacies and local services and hospitals. The INHS guarantees the provision of class A drugs and medications;
- supplementary assistance means the provision of medical devices and special food (i.e. gluten-free) for specific categories of patients;
- outpatient specialist assistance, which is made up of diagnostic activities, clinical activities dealing with specialist medical examination, therapeutic activities and rehab;
- prosthetic assistance;
- spa assistance;
- home and local healthcare assistance is healthcare services addressed to patients with chronic, terminal or mental illnesses, addictions and disabilities. According to the patient conditions, the healthcare services can be provided with a higher or lower intensity. The homecare services are divided into four different levels of intensity, depending on: treatment days, effective assistance days, coefficient of assistance intensity (which represents the frequency of homecare services during the treatment). Homecare is split into different levels according to these factors (Pelliccia, 2019):
    - base level homecare - less than 4 days per month
    - integrated homecare (ADI) level I - more than 4 days and less than 9 day per month;
    - integrated homecare (ADI) level II - more than 9 days and less than 15 days per month;
    - integrated homecare (ADI) level III - more than 15 days and less than 18 days per month;
    - palliative homecare treatments - more than 18 days per month;
    - family consultants;
    - palliative care and hospices;
    - infant neuropsychiatry services and therapeutic communities;
    - mental health services and therapeutic communities;
    - rehabilitation services, intensive, extensive and maintenance rehabilitation facilities;
    - addiction services, therapeutic-rehabilitative and pedagogical-rehabilitative communities;

- residential and semi-residential healthcare assistance is divided up into three different levels of intensity:

(1) highly intensive (for patients discharged from hospitals),

(2) extensive care (for patients in need of a continuity of care),

(3) long-term care and maintenance (for treatments that cannot be performed at home because of particular family/social situations).

### *1.3.2 Hospital care*

Hospital care is provided by the INHS free of charge. Hospitalisation is suggested at the discretion of the GP, the paediatrician, the Emergency Medical Service or the ED doctor.

The activity areas of hospitalisation are:

- emergency rooms are guaranteed within a hospital network made up of structures with different degrees of care and organizational complexities. These structures have a functional integrated correlation with each other thanks to a hub and spoke model. The hub and spoke model applied to healthcare is a method of organisation in which there is a main campus (a hub), which receives the heaviest resource investments and supplies the most intensive medical services, complemented by satellite campuses or spokes, which offer more limited services arrays at sites distributed across the served market (Elrod & Fortenberry, 2017).
    - ED inside the hospital: it is the organisational structure in which clinical stabilisation is performed during moments of distress and urgency, the diagnostic procedures are performed together with therapeutic treatments and the emergency hospitalisation. The ED is provided in a local area with a population between 80,000 and 150,000 citizens and in which the access to the ED is possible in a maximum of one hour, with more than 20,000 annual visitors (Ministry of Health, 2019).
    - Level I Emergency and Acceptance Department (Ievel I LEA): it is the spoke of the network, performing all the surgery and the distress acceptance for major injuries/illnesses. This structure is inside an area with 150,000-300,000 citizens with more than 45,000 annual visitors (Ministry of Health, 2019).
    - Level II Emergency and Acceptance Department (level II LEA): its catchment area is between 600,000 and 1,200,000 citizens and there are more than 70,000 patients accepted per year.

    - Hospital facility in particularly disadvantaged areas: these are activated in areas more than 90 minutes away from hub and spoke centres (or more than 60 minutes from the ED).
- ordinary hospitalisation for acute-defined cases: the national hospital network should allocate a specific number of beds for every 1000 citizens in order to guarantee access to the service. Based on the hub and spoke model, the hospitals' networks provide information on how to deal with illness management and organisational needs. In this way, the focus is on the patient and, more specifically, on the pathology-treatment. To provide an effective service that is characterised by the continuity of care, many different stakeholders are involved in the process. To better integrate and coordinate these stakeholders, strict procedures, methods and models are necessary in order to ensure the timeliness and compliance of therapeutic-care interventions. The hub and spoke model ensures that effectiveness is pursued through the provided services, which are as follows;
- day surgery;
- day hospital visits - one or more planned hospitalisation periods lasting less than one day and without an overnight stay. The day hospital activities should have the following features:
    - be multi-specialist in nature;
    - if necessary, it is possible to use hospitals' technological and professional resources;
    - guaranteed observational period after the patient is discharged.

  Such hospital activities may have diagnostic, therapeutic and rehabilitative purposes.
- post-acute rehabilitation and long-term care - rehab is the third pillar of the INHS, together with preventative and curative care. Rehab activities may be strictly related to healthcare activities or they may deal with social rehabilitation (i.e. allowing people with disabilities to participate socially in order to contain the disability itself). Rehab activities could be provided:
    - though hospitalisation or day hospital visits (intensive or extensive rehab);
    - though specialist outpatient care or day services;
    - through local and home care or residential and semi-residential healthcare services;
- transfusion activities - both for traumatic events, chronic conditions (congenital anaemia), and critical illnesses (leukaemia, cancer);

- cell, organ and tissue transplant activity - performed in a public hospital free of charge. The selection, the organ/tissue removal, and the transplant depend on the minimum structural, technological and organisational prerequisites;
- poison control centres (also known as CAVs).

Regions are in charge of the organisation and the management of the network of hospital care, which is provided on the basis of qualitative, structural, technological and quantitative national standards.

### 1.3 Some evidence from the COVID -19 experience

The Covid-19 pandemic has given us the chance to better analyse differences in regional healthcare management models as well as to better understand the key features of the INHS locally and regionally.

What we have seen so far in terms of an effect of regionalisation are the differences in healthcare approaches across the country when it came to managing Covid-19 pandemic.

Due to differences in the availability of facilities and resources and because of different healthcare models, regions dealt the pandemic in different ways during its initial stages.

Pecoraro et al. used 2020 data to analyse the different strategies adopted by regions and autonomous provinces in terms of hospitalisation, treatment in the ICU and at home. What was highlighted is that the majority of the regions implemented a home-based approach, while hospitalisation was preferred in Lombardy, Piedmont and Lazio (Pecoraro et al., 2021). This hospitalisation approach was used to handle the first period of the pandemic and then it was scaled back, with a more home-based approach being preferred.

The benchmark regions that could be taken into consideration in order to better obtain the analysis are Veneto (home-based approach) and Lombardy (hospital-based approach) so as to understand not only the approach used during the first stage of the pandemic, but also the evolution of these models and the convergence towards a more effective, efficient, safe and sustainable one.

The approaches of these two regions were the ones chosen for analysis on how the pandemic was handled (also because Lombardy and Veneto were the worst-affected regions by the pandemic) (Pisano et al., 2020).

What we have learned from the Italian approach (thus, Lombardy and Veneto) to the pandemic is the importance of systematic approaches to manage crisis situations, as well as the importance of preventing illnesses. Both the regions demonstrate how important it was for the

different stakeholders to work together in order to make an efficient use of resources and healthcare services.

When the pandemic first began to spread, the public health authorities issued guidelines about social distancing, contact tracing and treatments. The two regions transposed the guidelines in different ways during at the initial stages.

### *1.3.1 Lombardy's approach to the COVID-19 pandemic*

Lombardy opted for a conservative approach to testing, focusing its attention only on symptomatic cases. This led to a significantly lower number of tests being performed (Pisano et al., 2020).

Lombardy based its approach on hospitalisation (Monacelli & Polo, 2020):

- only a small amount of healthcare practitioners was tested during the first weeks;
- both EDs and hospitals were the key places for symptomatic patients;
- after testing symptomatic patients, families, friends, and any other kinds of contacts were not monitored.

This patient-centred approach consisted of using doctors, out-patient clinics, and the ED as the front line (Binkin et al., 2020).

The strategy pursued in the first weeks also consisted of:

- data collection to better understand the epidemiology and to conduct modelling;
- a huge effort in increasing diagnostic capacity;
- isolation and contact tracing;
- enhancement of the existing reinforced regional ICU network;
- division between Covid-19 facilities and non-Covid-19 ones;
- strict procedures for healthcare practitioners and guidelines for GPs (diagnosis, testing and hospital referrals).

This, together with the promotion of hospital-based assistance, led to a saturation bed occupancy and so to the failure of the initial division between Covid-19 and non-Covid-19 facilities. This occupation saturation and, more generally, the depletion of resources led to a decrease in the quality of care.

### *1.3.2 Veneto's approach to the COVID-19 pandemic*

Veneto implemented a broad community-based strategy that relied on the public health network and a local integration of services (Binkin et al., 2020).

This region opted for a mass screening approach, through mobile teams and with a wider focus (not only on symptomatic cases). This aspect is clearly important considering that the large majority of people infected were asymptomatic (Binkin et al., 2020). With this, together with the establishment of a team for epidemiological studies, it was possible to better understand how the virus was spreading and therefore, to better understand which kind of approach was suitable. In this way, the region was able to stifle the spread of cases inside healthcare facilities too (Pisano et al., 2020). The most important aspect of Veneto's approach was its testing strategy (Monacelli & Polo, 2020):

- the first element of this strategy concerned who was to be tested: starting with symptomatic cases and then moving towards each close contact;
- the second element concerned where to perform these tests: in order to reduce the spread, decentralised facilities and mobile teams were chosen.

Moreover, the decision to separate Covid-19 hospitals from non-Covid-19 facilities proved to be effective in terms of virus containment.

Some of the key actions pursued in Veneto were (Binkin et al., 2020):

- the identification of hospitals and recovery centres for Covid-19 cases;
- the increase the number of ventilators and the doubled ICU capacity (the supply of medical, technological and human resources);
- moving patients from Covid-19 hospitals to community hospitals;
- GPs having a stronger and more relevant role;
- mobile diagnostic teams;
- careful monitoring at home;
- rapid communication through an information system that unified the laboratory, GPs and the local public health units:
    - aggressive testing;
    - strict contact tracing (extended family, work and casual contacts too);
    - GP protection: telephone appointments instead face-to-face consultations;
    - moving diagnosis outside of healthcare facilities in order to reduce the spread of the virus.

### *1.3.3 What has emerged from the comparison*

Starting from the assumption that Covid-19 was an unexpected healthcare crisis and Veneto and Lombardy were the first regions most affected by the spread of the pandemic, it is important to consider the lack of information and the different *status quo* of the two regions.

During the first weeks of the epidemics there wasn't a *uniform modus operandi* because of the regionally-based Italian NHS. Each region developed a different approach due to (Pecoraro et al., 2021):

- the structure of the regional healthcare systems;
- the availability of resources;
- the availability of facilities and healthcare professionals.

Veneto's approach appeared to be a benchmark to revisit the regional and central policies. Indeed, after the first weeks of Covid-19 spreading across Italy, other regions started to exploit some aspects of Veneto's approach, such as:

- accelerating the diffusion of knowledge and explaining what wasn't working;
- the importance of collecting and disseminating data, analysing epidemiological information and ensuring the data precision (using comparable data and through the conversion towards similar testing approaches) (Pisano et al., 2020);
- inpatients being treated at home.

After the first stage of the pandemic, a convergence in healthcare approaches arose. All regions opted for a home care approach with a significant reduction in the number of patients being treated in hospitals (Binkin et al., 2020).

Indeed, Lombardy's first phase approach proved to be:

- less effective on the whole;
- less efficient in the management of resources;
- highly risky (Covid-19 spread inside hospital facilities);
- less sustainable.

On the other hand, Veneto's approach proved to be:

- more effective on the whole, ensuring a higher level of care quality;
- more efficient in terms of resource allocation and costs;
- less risky, ensuring a higher level of safety for both patients and medical staff;
- more sustainable.

Despite the myth of the Italian hospital-based healthcare approach having established itself as one of the best over the years, the Covid-19 pandemic, and more specifically the healthcare approaches improved to deal with this healthcare crisis, proved that "*Western health care systems have been built around the concept of patient-centred care, but an epidemic requires a change of perspective toward a concept of community-centred care"* (Nacoti et al., 2020).

This analysis, as we will further elaborate on, lays the groundwork in the comparison of the pre-Covid-19 era and the post-Covid-19 one in healthcare terms (Fig. 1.1).

| | **Lombardy (Hospital-centered care)** | **Veneto (Community-centered care)** |
|---|---|---|
| **Healthcare facilities** | Failure in the attempt to address facilities only to non-Covid patients, due to the saturation of Covid-19 facilities (Binkin et al. 2020) | Effective division between Covid-19 facilities and non-Covid ones (Binkin et al. 2020) |
| **Individual effectiveness** | Less effective at the individual level | More effective at the individual level |
| **Collective effectiveness** | Less effective at the collective level | More effective at the collective level |
| **Efficiency** | More efficient | Less efficient |
| **Sustainability** | Less sustainable | More sustainable |

*Figure 1.1 – Saviano & Perillo, 2021b.*

From this standpoint, on one hand, the community care model shows higher potential in terms of effectiveness, efficiency, safety and sustainability booth at individual and collective levels; on the other hand, the community-based approach presents a higher level of complexity to manage

## 1.4 Lessons learnt from the COVID-19 pandemic

The pandemic exposed the vulnerabilities of the INHS (such as in other countries).

The already existent economic, social, and healthcare crises have been exacerbated by Covid-19. The experience of the pandemic, in the light of the above analysis, leave as the lessons learnt by this crisis:

- The central strategic healthcare leadership has proven weak due to to the regional-based governance models;
- The fragmentation of health services has restricted timely interventions and effectiveness (Armocida, et al., 2020), showing a low level of territorial cohesion;
- The hospital-based governance model proved to be less effective in service provision rather than community and homebased ones, tracing the main different approaches to the reference cases (Binkin, Michieletto, Salmaso, & Russo, 2020) of Lombardy and Veneto (Timelli & Girardi, 2021);
- One of the main weaknesses has been hospitals' management. Hospitals could have been a strategic element to face the pandemic, referring to the ideal hub and spoke model. However, the previously existing crisis due to years of expenditure reduction and the absence of coordination between different governance levels made the INHS severely unprepared to face such a crisis;
- There are unsolved structural deficits, such as lack of coordination, lack of multidisciplinary care teams, inefficiencies in the continuity of care (D'Ambrosio Lettieri, 2021), non-adequate facilities, and a non-efficient management of resources;
- A change of paradigm is strictly necessary.

Clearly, the community care approach shows higher potential in terms of effectiveness, efficiency, safety, and sustainability both at individual and collective level. On the other hand, the community care approach presents a higher level of complexity to manage.

The pandemic generated the necessities to better allocate resources, to rethink and reshape both treatment and the way in which services are provided, to redesign governance models, and rethink the role of the different actors.

The necessity to strengthen the INHS in no longer postponed. It is necessary to innovate the system on the governance, social and institutional levels promoting political, economic, and organizational solution that will be sustainable in the middle-long term (Borgonovi, 2015). Covid-19, as all the crises do, only accelerated the necessary process of evolution and innovation of healthcare.

This necessary evolution, as shown by the pandemic, should be addressed to the promotion of community care. This shift from the hospital-based governance model to a community and homecare one will be an interpretation key for the further analysis, leading to questions related to how it is possible to pursue such a transition, and which are the conditions to assure effectiveness, efficiency, sustainability and safety.

Within this framework, given the context of the Covid-19 pandemic, a SWOT analysis may be useful to understand so as to be able to investigate and identify the effectiveness, efficiency, and sustainability (Quattrociocchi et al., 2018) features of healthcare models, and in particular, of homecare models. To do so, we need to identify not only the strengths and the weaknesses linked to the structure, but also the opportunities and threats given the context.

*Opportunities*

The ageing population, the focus on prevention and the availability of highly skilled human resources represents a great opportunity for the INHS.

The current model which focuses on hospitalisation (and therefore on treating the illness) has proved to be the best choice thus far. The arising necessity for long term care leads to the existence of new places of care and the need to shift from hospital care towards local and home care. The existent complexities in healthcare highlight the possibility to rethink places of care and the regional healthcare model, allowing us to identify the effectiveness, efficiency, safety, and sustainability features to devise a new approach to healthcare.

It is possible to say that Covid-19 defines the boundaries between two eras: a pre-pandemic era and a post-pandemic one. What emerged from this experience is that moving healthcare from hospitals towards the local and community level pose a great opportunity that is yet to be fully explored. The arising opportunities deal with:

- less rigid protocols that enable the integration of healthcare stakeholders and allow for the involvement of the patient and their families;
- these less rigid protocols enable the definition of an extended eco- system (Polese & Carrubbo, 2016), in which resources are integrated in context;
- the focus is no longer on the single activities, but on the service provision;
- the focus being shifted towards prevention;
- the possibility to pursue more personalised forms of treatment thanks to community and homecare services, the integration of different stakeholders, and the integration of resources within the context.

*Threats*

The regionalisation of the healthcare system may lead to an abuse of power by regional governments (Hannes et al., 2015). Some regions, indeed, spend almost all their budget on healthcare, creating a power imbalance (Hannes et al., 2015). One of the biggest threats remains the usage of economic resources, balancing on the one hand the necessity to cut healthcare

costs, and on the other, to efficiently use the resources. Due to a huge usage of economic resources in some regions, taxes have also risen, creating a distortion in the system, as black markets and bartering have become a way to avoid high taxes (Maris, 2014). Curbing the expenditure, making the resource usage efficient, is one of the biggest threats to our NHS, especially with regards to the EU's Maastricht criteria.

Healthcare finance and provision in Italy is unusual by international standards: public financing relies heavily on both general taxation and social insurance, and although the vast majority of expenditure is publicly financed, the majority of care is provided by the private sector (Paci & Wagstaff, 1993).

Another important threat is the ageing population, which leads to long-term care and chronic illness. Thus, the necessity to integrate healthcare activities and resources is crucial and complex. The INHS has been facing the need to approach healthcare in a more all-rounded manner and not just horizontally, by providing healthcare services intended as treatment services, but a holistic approach is necessary. Within this framework involving different stakeholders in the value co-creation process, it could be difficult to pursue effectiveness, efficiency, safety and sustainability.

During the pandemic, the most relevant threats faced by our INHS have proven to be:

- a scarcity of resources such as drugs, medication, medical devices and so on (due to extreme globalisation and the trade difficulties that arose during the pandemic);
- the impossibility to ensure the safety of medical personnel whilst providing care;
- difficulties in seeing patients whilst ensuring safety for GPs, nurses, etc… and patients and families;
- the structural limits of the healthcare facilities.

*Strengths*

The first most important strength, above all others, is the high-quality level of healthcare services for all citizens. Access to health, as previously said, must be guaranteed through hospital care, emergency care and primary care provided by GPs and paediatricians.

This means that there isn't any kind of discrimination when it comes to accessing healthcare and each citizen is able to benefit from healthcare services.

Principles of universality, equity and solidarity are at the core of our NHS, allowing access to healthcare without any kind of discrimination and ensuring the provision of healthcare services for everyone in need.

The INHS, which follows the Beveridge model and is publicly financed and structured around regional autonomies in order to provide a better response to the different needs across Italy, is an exemplary model in Europe. This means that all the services included in the positive LEAs list are equally accessible across Italy. In Italy, indeed, all the drugs for the treatment of serious and chronic diseases, including the latest-generation innovative medicines are provided free of charge (Ministry of Health, 2019).

Also, the standards of quality and safety are ensured by national criteria, which leads to facilities that are well-equipped with the human and technical resources necessary to ensure the delivery of the service.

Prevention is at the core of the INHS. The focus is not only on treating illness, but the real aim of Article 32 of the Italian Constitution is to prevent illness from occurring by focusing on ensuring citizens' health and well-being.

During the pandemic, the real strength of our INHS could be identified as follows:

- its capability to adapt the governance model based on the availability of resources (financial resources, medical personnel, facilities, and so on);
- highly skilled medical personnel;
- patient-centred approach;
- capability to move from hospitalisation towards community and home care;
- the use of technology to enable and enhance communication and innovation.

*Opportunities*

In terms of weaknesses, the regionalisation, which was established in order to make the system more efficient as the regions could better accommodate their own health priorities (Hannes et al., 2015), also represents a weakness for our system.

The shared responsibility between central government, which defines the LEAs, and the regions, that organise the healthcare provision, may lead to huge discrepancies in services across the country.

Nowadays, all the regions and the autonomous provinces are able to decide on their own healthcare expenditure and how it is funded. Regions can also decide how to organize ASLs, the degree of autonomy for hospitals and university hospitals, the role of the IRCCS and the governance, coordination and centralisation stakeholders involved in the process (CERGAS, 2019).

This way, many different governance models arise, dealing with financing and provision activities (taking both inside the ASLs or with the ASLs in charge of the financing and the hospitals in charge of the health provision) (CERGAS, 2019).

Some regions, such as Lombardy, have embraced a privatisation of the healthcare system, while others have chosen a cooperative approach (Hannes et al., 2015).

This means that citizens can face different approaches across Italy. The existing governance models can be divided up as follows due different financing mechanisms, governance models and resources allocation policies (Pecoraro et al., 2021):

- Patient (hospital)-centred - using the network of public and private facilities (followed in Lombardy, Piedmont, Lazio, mainly during the first outbreak of the pandemic);
- Community-based - (used by the majority of Italian regions – e.g. Veneto, Tuscany) it relies on public health network and local integration services;
- Mixed hospitalisation-home based model.

These models shouldn't differ, in theory, in terms of quality of the service, effectiveness, efficiency and safety of the healthcare provision. As a matter of fact, and as we will analyse in this work, there are many differences.

During the pandemic, the most relevant weaknesses can be summarised as follows:

- different governance models – leading toward different outcomes and to differences in the provision of the service (leading to deficiencies such as healthcare tourism, differences in DRG costs across different regions, and so on);
- an initial focus on the hospitalisation, which led to the reduction in the quality of care and the saturation of beds;
- a saturation of available resources, leading to an inefficient usage of resources);
- a scarcity of medical personnel.

## 1.5 The Italian National Recovery and Resilience Plan (PNRR): the future community care and the role of telemedicine

This evolution toward home and community care models has been accelerated by Covid-19 pandemics and it is part of a relevant evolution of healthcare services as we know them.

The best resource to understand the future of the new community care is the National Recovery and Resilience Plan[3], the strategic document prepared by the Italian Government to have access to Next Generation EU funding programme.

PNRR represents an ambitious, strategic, and unmissable opportunity to innovate and recover Italy, heavily affected by Covi-19 pandemic, which amplified the already existing healthcare, economic, social, and ecological crisis.

Our country even before the pandemic was lagging behind other advanced European Nations, with productivity problems, a fragmented productive supply chain and a low propensity to adopt new technologies, both in the private sector and in the public administration.

PNRR aims to face the immediate consequences of the pandemic and to resolve the structural issues which have slowed down national economic and social development in the last 20 years.

First, this is due to weak investment dynamics and administrative capacity in the public sector, but also to several structural factors such as cross-cutting (health), and in incomes, gender, generations and territorial disparities.

Italy, therefore, must combine imagination, design skills and concreteness, to deliver to the next generations a more modern country, within a stronger and more united Europe.

### *1.5.1 The 6 Missions of the PNRR*

The PNRR has been approved on the 30th April 2021, with the aim to:

- relaunch the country after the pandemic crisis, stimulating an ecological transition and a digital transformation;
- fostering structural change in the economy, starting with the fight against gender, territorial and generational inequalities;
- update national strategies on sustainable development and mobility, environment and climate, health supply chain.

The six intervention areas of the Plan are:

- green transition,
- digital transition,
- smart sustainable and inclusive growth,
- social and territorial cohesion,
- health and economic, social and institutional resilience,

[3] Piano Nazionale di Ripresa e Resilienza, cited as "PNRR" from now on.

- policies for new generations, both children and young people (Governo Italiano, Presidenza del Consiglio dei Ministri, 2021).

The Missions of the PNRR are:

- Mission 1: Digitalization, innovation, culture and tourism. It supports the digital transition both in the modernization of public administration, in communication infrastructures and in the supply chain. The aim of this mission is to ensuring the coverage of the entire territory with ultra-broadband networks, improve the industrial supply chains competitiveness, and facilitate the internationalization process of enterprises. It also aims to relaunch two relevant Italian industries: tourism and culture;
- Mission 2: green revolution and ecological transition. It includes:
    - actions for sustainable agriculture and to improve waste management capacity;
    - investment and research programmes for renewable energy sources;
    - investments for the development of the main industrial chains of ecological transition and sustainable mobility;
    - actions for the efficiency of public and private real estate;
    - initiatives to fight hydrogeological instability;
    - initiatives to safeguard and promote the biodiversity of the territory, to ensure security of supply and sustainable and efficient management of water resources;
- Mission 3: infrastructures for sustainable mobility. The aim of this mission is to strengthen and extend the national high-speed rail network and strengthen the regional rail network, with particular attention to the middle and southern regions. It strengthens the services of goods transport, according to an intermodal logic in relation to the system of the airports. It promotes the optimization and digitization of air traffic, and aims to ensure the interoperability of the national logistics platform for the harbors' network;
- Mission 4: Education and research. It aims to fill the structural, quantitative and qualitative gaps in the supply of education services in our country, throughout the training cycle. It provides for an increase in the availability of places in kindergartens, promotes access to university, strengthens guidance tools and reforms the recruitment and training of teachers. It also includes a significant strengthening of basic and applied research systems and new tools for technology transfer, to increase growth potential;
- Mission 5: cohesion and inclusion. This mission aims to:
    - invest in social infrastructure, strengthens active labour policies and to support the dual system and female entrepreneurship;

    - improve the protection system for situations of social and economic fragility, for families, and for parenting;
    - promote the role of sport as a factor of inclusion;
    - strengthen the Universal Civil Service and promotes the role of the third sector in public policies;
- Mission 6: Healthcare. The main components of this mission are:
    - proximity networks, territorial facilities and telemedicine as tools for community care. Territorial facilities (such as 'Case di comunità' and 'Ospedali di Comunità') will be built to enhance community healthcare services; homecare will be enhanced, telemedicine will be developed, together with an effective social and health services integration (ibidem);
    - Innovation, research and digitalization for the INHS, together with investments in addressed to scientific research and in technology transfer, as well as strengthening the skills and the human capital of the INHS, also through healthcare personell training (ibidem).

The economic resources allocated by the PNRR are 191.5 bln of euros, 68.9 of them are non-rapayable and spread across the 6 mission of the plan:

- Mission 1 – 40.29 bln of euros
- Mission 2 – 59.46 bln of euros
- Mission 3 – 25.4 bln of euros
- Mission 4 – 30.88 bln of euros
- Mission 5 – 19.85 bln of euros
- Mission 6 – 15.63 bln of euros

### *1.5.2 Mission 6: Healthcare*

Healthcare is the Mission 6 of the PNRR. Covid-19 pandemic has proved the universal value of health as a fundamental public good, and the macro-economic relevance of public healthcare services, which could be challenged and aggravated by the increased demand for healthcare serviced due to ongoing demographic, epidemiologic and social trends.

The analysis run in the previous paragraphs highlighted the issues of our INHS exacerbated by Covid-19 pandemics, and the importance of being able to rely on the appropriate exploitation of the most advanced technologies, high digital competencies, professional and

managerial skills, new processes for the delivery of care services and a more effective link between research, data analysis, care and systemic programming and management.

PNRR aim to address all the critical factors in a synergic way, through a huge effort in terms of reforms and investments addressed to align services offering to different patients' needs across the country.

A large part of the economic resources is, indeed, addressed to improve the infrastructural and technological equipment, to promote research and innovation, and to develop technical and professional, digital and managerial competencies.

### *1.5.3 M6C1: proximity networks, facilities and telemedicine for community healthcare*

The first component of mission 6 is related community housing and personal care, home as a first place of care and telemedicine, and the reinforcement of intermediate healthcare and its facilities (community hospitals) (AGENAS, 2022).

The aims are to:

- Enhance the INHS, align services offering to community and patients' needs, also in the light of Covid-19 pandemics;
- Strengthen proximity healthcare facilities and services, and homecare services;
- Develop telemedicine and overcome the fragmentation and the differences in the level of services offered across the Country;
- Develop telemedicine solution to sustain homecare.

It is not disputed that this component aims to develop and to implement a new community healthcare model based on proximity to the patients. To do so, a reform of the governance model of the community healthcare network will be necessary. It will be based on:

- Promoting homecare, also through telemedicine;
- The creation of new healthcare structures and facilities on the territory, to improve accessibility and to increase the availability of proximity services to citizens;
- The definition of a new institutional framework for health, environmental and climate prevention, in line with an integrated approach (One Health) and with a holistic vision (Planetary Health).

The investments related to M6C1 are:

- Investment 1, that aims to strengthen and to reorganize the services offered on the territory, with a view to improving the quality of the Community Houses and taking charge of the person. The Houses of the Community are the place in which the social

and health integration happens. These will be the physical facilities in which a multidisciplinary team will work. The team will be composed by: general practitioners, free-choice paediatricians, specialist doctors, community nurses and other healthcare practitioners. It could also host social workers. The function of these facilities will be to interpret community needs in order to define a healthcare plan and to define the priorities for action. In this way, the Houses of Community will become the physical place in which the encounter between the patient and the service provider (the INHS) will happen, characterized by the proximity, and easily to identify. These investments involves the creation of 1288 Houses of Community before the second half of 2026. Both existing and new healthcare facilities could be used to implement the plan;

- Investment 2, addressed to enlarge the volume of healthcare services provided through homecare. These services will be intended for patients older than 65 years and with one or more chronic illnesses and/or non-self-sufficient. To do so, the intended actions are: the identification of a shared model to provide homecare services, using new technology (such as telemedicine, robots, digitalization); the implementation, at each ASL of an information system capable of collecting clinical data in real time; the activation of 602 Territorial Operational Centres (COT), one in each district, which represent a territorial organizational model that aims to ensure continuity, accessibility and integration of care and assistance.
- Investment 3, that aims to empower and enlarge the intermediate services on a community level, through Community Hospital, that is a health facility of the territorial network for short-term hospitalization and intended for patients who require medical interventions at medium/ low clinical intensity and for short-term hospitalization. This structure, normally equipped with 20 beds (up to a maximum of 40 beds) and mainly nursing management, contributes to a greater appropriateness of care resulting in a reduction of improper access to health services, such as those in the emergency department or other hospital accommodation or other specialised services. The Community Hospital will also be able to facilitate the transition of patients from acute care to their homes, allowing families to have the necessary time to adapt the domestic environment and make it more suitable for the needs of patient care. The investment will be realized in the realization of 381 Community Hospitals. Again, the implementation of the intervention will benefit from coordination tools between the institutional levels involved.

### *1.5.4 M6C2: Innovation, research, and digitalization for the INHS*

The second component of Mission 6 is related to innovation, research, and digitalization. The aim of this component is to promote:

- the technological and digital update,
- training, scientific research and technology transfer (AGENAS, 2022).

The objectives of M6C2 are:

- develop a public health system that values investments in the health system in terms of human, digital, structural, instrumental and technological resources;
- strengthening scientific research in the medical and health fields;
- strengthen and innovate the technology and digital structure of SSN at Central and Regional level, to ensure a significant evolution of healthcare modalities, improving the quality and timeliness of care, enhancing the role of the patient, as an active part of the clinical-care process and ensuring greater capacity for governance and health planning guided by data analysis, in full respect of security and data and information protection.

The final objective is to strengthen the relationship between research, innovation and healthcare services through the revision and updating of the regulatory framework and the legal regime of the Institute of Scientific Hospitalization and Care (IRCCS), and the research policies of the Ministry of Health.

The IRCCSs are a peculiar characteristic of our INHS being the places of scientific and clinical research. The reform will allow to bring therapeutic innovation directly to the patient, to facilitate specialistic knowledge and competences exchange between different IRCCSs and between an IRCCS and other INHS facilities.

The investments related to M6C2 are:

- Investment 1.1, which concerns the modernization of the technological and digital hospital equipment, though the purchase of 3,133 new large equipment with high technological content (CT scans, magnetic resonances, Linear Accelerators, Fixed Radiological System, Angiographs, Gamma Camera, Gamma Camera/CT, Mammographs, Echotomographs, Defibrillators, Portable electrocardiographs) and multipurpose systems for direct digital radiology for emergency departments' examinations. It also evisage the structural strengthening of NHS hospitals offering;

- Investment 1.2, which aims to outline a path of structural improvement in the field of safety and sustainability of hospital buildings, adapting them to the current regulations on construction in seismic areas and areas at high risk of hydrogeological instability;
- Investment 1.3:
    - Ensure the widespread of the Electronic Healthcare Record4, its homogeneity and accessibility across the national territory by the both patients and healthcare professionals;
    - The empowerment of the INHS technological infrastructure to assure the LEAs and the healthcare surveillance. The aim of this project is to strengthen the New Informatic Healthcare System (NSIS), addressed to LEAs monitoring and the planning of healthcare services aligned to citizens' needs, and to new demographic and epidemiological trends.
- Investment 2.1, which aims to strengthen the system of biomedical research in Italy, strengthening the response capacity of the centres of excellence in Italy and encouraging the transfer of technology between research and enterprises;
- Investment 2.2, addressed to strengthen training in basic medicine, introduce a special training plan on hospital infections and ensure a strengthening of the managerial and digital skills of healthcare personnel, since scientific progress and technological innovation require health professionals to be regularly updated and trained to achieve the effectiveness, adequacy, safety and efficiency of the services provided by the INHS.

### *1.5.5 The role of telemedicine in the PNRR*

Telemedicine, as highlighted in the previous paragraphs, is one of the core elements of M6C1 of the PNRR, that aims to promote telemedicine though digitalization.

The relevance given by the Plan to telemedicine is due to its ability to shorten the geographical barriers and differences in healthcare service provision, through harmonized standards of care enabled by technology. In this way it is possible to improve the patients' care experience and the effectiveness of regional healthcare systems.

The funding made available by Investment 1.2 addressed to telemedicine is equal to 1 bln of euros. The funding will be addressed to enhance homecare services and to support chronic patients (older than 65 years with one or more chronic illnesses and/or non-self-sufficient)

4 Fascicolo Sanitario Elettronico.

thanks to an enlarged services offering provided at a home-based level. The final objective is to take in charge the 10% of patients older than 65 by mid-2026. Projects related to M6C1 can involve different services, such as: teleassistance, teleconsultation, telemonitoring, telerehabilitation and so on. The projects, to be funded, must have the following characteristics:

- ability to integrate with the ESF,
- achieve quantitative performance targets linked to the main objectives of telemedicine and INHS,
- ensure that their development results in effective harmonisation of health services.

telemedicine, on the one hand, will enable new solutions addressed to patients' healthcare demand. On the other hand, it will pave the way for new opportunities and the evolution of the INHS, though the integration of different healthcare practitioners, the patient, caregivers and families.

The reasons behind this trajectory of evolution are:

- allow equal access to healthcare services, also for citizens of rural or remote areas;
- improve quality of care ensuring continuity of care, in particular for chronic patients;
- better effectiveness, efficiency and sustainability, also improving the therapeutic compliance;
- reduction in healthcare public expenditure;
- contribution to the economic development of the country, taking into account that the industry of technologies applied to medicine presents a high rate of innovation and job creation.

Thus, given this overview and these premises, the evolution of healthcare towards community care can no longer be postponed. This paves the way for continuing our investigation on community healthcare and on technology role in this evolution. The main characteristic of this evolution of the INHS will be the patient-centered approach and the improvement of community care.

## 1.6 The key general problem to address: the need to shift from hospital care to community and home care

What arises from the comparison of different regional healthcare models and from the premises and opportunities given by the PNRR is the need for a patient-centred approach and the improvement of community care.

Giving a definition to patient-centred care (PCC) isn't easy. A definition may include the relationship between the patient and the care provider, the access to care and the continuity of that care, the role of the patient in the value co-creation process (Caputo et al., 2018) and in the delivery of healthcare services, and the self-management of the patient (Bergeson & Dean, 2006; Hallo et al., 2021). A definition of the PCC, given by the American Institute of Medicine, may be *"Providing care that is respectful of and responsive to individual patient preferences, needs, and values and ensuring that patient values guide all critical decisions"* (Institute of Medicine, 2001).

On the other hand, it could be easier to define the critical factors that enable patient-centred care rather than to give a precise definition:

- awareness of specific patient needs,
- patient empowerment and literacy,
- family and patient involvement in the healthcare value creation process (in the decision-making process, in the treatment, etc),
- patient perception, expectations and satisfaction,
- the integration of different healthcare practitioners.

The final goal is to provide high quality healthcare, which is effective, efficient, safe and sustainable. In addition, to realise the benefits of quality health care, health services must be timely, equitable, integrated and efficient (World Health Organization, 2019). The three elements of PCC to address this kind of healthcare services in day-to-day practice are (Sidani et al., 2016):

- holistic care, referring to a comprehensive care that covers all the different domains of healthcare, involving illness management on the one hand, and health promotion on the other;
- collaborative care, which is the process of patient involvement in the decision-making process and the treatment;
- responsive care, which reflects the individualisation of care or treatments, with the goal of enhancing their fit with the patient's characteristics and preferences. This last element deals with the modification and the iterative adjustment process of the care plan.

With the introduction of patient-centred care, there is a shift of focus towards the outcomes such as safety, patient values and needs, compliance, and effectiveness (Grob, 2013).

Placing the patient at the centre means that *"they are the experts who work alongside the professionals for the best results"* (Hallo et al., 2021). Further to this, for the care provider it

is crucial to understand the standpoint of the patient to better understand how to fit the healthcare needs. There is, indeed, a convergence toward the concept of the humanisation of healthcare services, shifting the attention toward the relationship between the user and the other relevant stakeholders (Saviano et al., 2018).

The involvement of the patient and the family is not the only element that is crucial to ensuring compliance with the treatment. By giving feedback and providing information on specific needs and on how the patient responds to the treatment it is possible to customise the treatment plan to better meet the effectiveness goal. Patient-centred care activates a process of service improvement on an individual level, a community level, a national level and beyond, and there is also a positive economic impact with a reduction in the cost burden of ill health on society (Hallo et al., 2021).

There is also a relevant psychological component when it comes to healthcare. Theories like human agency and self-determination formalise the importance of patient empowerment and its role in the value co-creation process (Wehmeyer & Little, 2013). The role of patients, their involvement in decision-making and in treatments affects their health and wellbeing. The focus, indeed, is moved from the patient to the person. The focus is not on the disease but on the context, made up of relationships between different stakeholders adopting a biopsychosocial perspective and shared decision-making (Tramonti et al., 2020).

The need for a patient-centred approach also arises from the increasing degree of complexity of healthcare. Thus, PCC is the answer given to the need for a systems approach in healthcare.

This approach proves its potential when dealing with chronic illness. Patients with chronic illness and their caregiver undergo an all-encompassing experience in terms of 'living with the disease', as well as dealing with the treatments' effects, and the relationship with the different healthcare practitioners and the INHS (Padula et al., 2016). The interaction between patients, caregivers and the medical staff allows for the care to be more customised. The precious contribution of patients and caregivers allows healthcare practitioners to better understand the clinical picture and to better fit the care needs. Patients, in this way, become the driving force behind the health process, ensuring that the problem is fully understood, giving constant updates on the treatment and the disease, and ensuring compliance with the treatment plan. The key factors of this partnership between patients and the other stakeholders are (Padula et al., 2016):

- patient empowerment,
- patient literacy and health education,
- clinical ethics,

- precise roles and responsibilities,
- prevention and conflict resolution,
- communication
- cooperative leadership.

A patient-centred approach, with respect to a traditional hospital-based approach, allows a degree of care customisation that matches the actual complexity of the single disease.

Customisation involves fine-tuning some aspects of the treatment to fit the needs and characteristics of individual patients. However, there are no clear guidelines for customising many treatments delivered in acute care settings, to address patients' physical, emotional, social and spiritual needs (Dozois et al., 2014), leaving health professionals ill-equipped to implement this element of PCC (Sidani et al., 2016).

It is possible to say that customisation in healthcare can be activated thanks to PCC.

The patient-centered approach (Fiano, et al*.,* 2022) could only be pursued through community and homecare provision models.

## Concluding remarks

In this chapter we analysed the context, aiming to understand the rules, regulations, and organisation of healthcare in Italy at a central level. On the other hand, we aimed to conduct a first analysis on Covid-19 evidence, to depict differences between different regional healthcare governance models and in order to understand the most relevant elements of the SWOT analysis.

As shown by this first stage of analysis, community and home care are proving to have a great potential that is yet to be fully explored. The shift toward them is part of a huge evolution of healthcare, which is also reported in the PNRR. This evolution consists in a transition from the physical dimension of care to a digital one, that will be further examined in the following chapters.

Given this context and the first relevant information coming from the analysis of the pandemic evidence, it will be possible to understand how this potential could be exploited. The interpretative methodological framework will be the next step to deciphering how to manage healthcare complexities, and even more so, community and home care services, to exploit all its potential.

Thus, the macro-question of research emerges: in the light of the PNRR, which are the conditions enabling the future community and proximity healthcare?

# CHAPTER II – A MULTISTEP INTERPRETATIVE METHODOLOGY

Once the general research question is defined, the lenses for framing and interpreting the problem under analyses have to be defined. To do so, the selected frameworks are the Viable Systems approach, the Service Science, and the Service Dominant logic, that are well established theories for the management of complex systems. The integration of these three frameworks is well established, also. Indeed, an integrated service and system framework will be defined in this chapter, taking into account the criteria of effectiveness, efficiency, safety and sustainability, and considering the context conditions, as suggested by the VSA. This integrated service and system framework will provide us with the lenses to interpret and frame the comparison between hospital based and community/home based provision models to address the research question related to the enabling factors of community and proximity care. The shift from a static to a dynamic view leads to a theoretical potential of knowledge co-creation, dealing with:

- The Service Dominant logic inspiring understanding
- the Viable Systems Approach approaching understanding
- the Service Science source of multi-disciplinary knowledge

Then, also a service science three-dimensional scheme is used to go deeper in the research, to frame, and to interpret the problem under focus.

We selected the lenses for framing and interpreting the problem under focus considering that he Viable Systems Approach, with its structure/system paradigm, is a well-established framework for management of complex systems, together with Service Science and S-D logic. The integration of these frameworks is well established in management, also, thus the decision to analyse the phenomenon through an integrated service and systems framework.

From this, the first theoretical hypothesis is derived. Then the first interpretative hypothesis is derived though literature review, that is further investigated in the case-study based exploration.

## 2.1 Aim of the study

Covid-19 experience highlighted weaknesses and strength of the INHS and its governance model. At the same time, opportunities for healthcare have emerged. These opportunities suggest a shift from hospital-based models toward community and home care ones.

The study, thus, aims to investigate the condition of effectiveness, efficiency, safety, and sustainability of the necessary evolution of healthcare toward community and home care models. To ensure that this evolution will take place, the implementation of new technologies will be necessary to enable community and home-based healthcare services provision.

This research is run also in the light of PNRR guidelines, area of development and investments addressed to what is defined the *future healthcare.* The vision, indeed, for the evolution of healthcare models designed in the Plan, is toward community and proximity care and the investments in new technologies.

To investigate the key question of this work, which is the need to move from a hospital-based healthcare to a community and homecare one and the role of technology innovations in this transition, we will design a model through which it is possible to make a comparison between hospital care and community/home care, through the interpretative framework of the VSA. This model will enable us to analyse complex phenomena and compare them in order to find the currently unexplored potential and to understand how to exploit it. The integration of VSA and S-D logic will give us as the lenses to frame and to interpret the evolution of healthcare toward community and homecare.

In the end, we will use a service and systems reference model to develop the first interpretative hypothesis, that will be further investigated trough the following steps of the research consisting in the literature review and the explorative empirical investigation.

## 2.2 The multistep methodological approach adopted

The issue under analysis, healthcare, and more specifically community and home care, presents a high level of complexity. Thus, a holistic view and a multidisciplinary approach will be used.

The methodological approach used to frame and interpret the possible evolution of healthcare, which is complex by definition, toward community and homecare will be divided into 3 different steps:

- framing the interpretative approach, analysing the contribution of the Viable Systems Approach and the Service Dominant logic and defining an integrated interpretative framework of synthesis to develop the first interpretative hypotheses.
- deepening the literature state of the art through a multi levels bibliometric analysis to further develop the interpretative hypotheses;
- assess the developed interpretative hypotheses through a case-study based empirical exploration, which is run on the case-study related to the implementation of telemedicine programs at Nuova CTA, a healthcare facility for physiotherapy and rehabilitative care, using Khymeia telemedicine technology.

## 2.3 Step 1: Framing the interpretative approach and formulating the first interpretative hypotheses

To grasp the complexity of healthcare, systems thinking is an ideal framework for capturing the multi-layered aspects of illness, from the biological processes that lead to a given disease to the social context where people live (Tramonti et al., 2020).

In this work, we use the lenses of Viable Systems Approach, Service Science and Service-Dominant logic to design an integrated framework of synthesis and the Bolton et al. cube as a reference Service & Systems model.

### *2.3.1 The contribution of Viable Systems Approach, Service Science, and Service Dominant Logic as general conceptual frameworks of reference*

The healthcare systems should be seen as a service system (Aquino, Barile, Grasso, Saviano, 2018), characterized by structural relation and systemic interaction.

To grasp the complexity of healthcare, the lenses of VSA, SS and S-D logic are necessary.

The Viable Systems Approach, being broad, multidisciplinary, and based on systems thinking gives us a key framework to interpret complex phenomena, considering the relational approach of healthcare organizations (Barile & Polese, 2010).

On the other hand, Service Science and Service Dominant Logic give us the instruments to analyse the service characteristic of healthcare.

These lenses will allow us to understand the phenomenon of the evolution toward community and homecare in its whole complexity, understanding the systemic and structural components, relations and interaction that take place in the complex healthcare ecosystem, both the context

and subjective view (Pels, Barile, Saviano, et al., 2014) and its service-driven nature. Thus, these lenses of VSA, SS and S-D logic will be proposed in a synthesis framework functional to find the first interpretative hypotheses, to define the hypotheses arising from the literature review and to run the empirical investigation.

In this framework, the answer to patients' needs are healthcare services that are characterised by effectiveness, efficiency, and sustainability. The analysis not only considers the provider-client relationship (Kongstvedt, 2001), but also the value co-creation process in which patients and other stakeholders are involved (McColl-Kennedy et al., 2012).

In healthcare, in this provider-client relationship we have:

- providers: doctors, nurses, administrators, hospitals, clinics, etc,
- clients: patients, families, friends, etc.

They are both resource integrators that ensure the system viability. In the provider-client relationship, usually clients have a passive role. In community and home care models, as highlighted through the VSA and S-D logic lenses, the role of clients becomes crucial in the value co-creation process. The inclusion of clients/patients in the service process provides advantages in terms of cost reduction and effectiveness (McColl-Kennedy et al., 2009). The need for an efficient use of the limited available resources leads to an interpretation of the concept of effectiveness which is linked to a perspective of sustainability (Saviano et al., 2010). Thus, again, we understand the importance of the criteria selected to design the interpretative framework.

The given conceptual framework stemming from the convergence between SS, VSA, and S-D logic aims to promote the condition of consonance and resonance in the healthcare system, as well as to use the fundamental premises, axioms, and foundational concepts of S-D logic and VSA to design a model in which it is possible to depict the effectiveness, efficiency, safety and sustainability features of healthcare services, and more precisely, community and home care, highlighting the relevance of preventative care and personalisation of treatment. In our INHS, which is a complex system, the decision-making power is distributed between central government and the regions. This framework allows us to understand how this complex system is evolving towards community and home care, preventative care, and treatment customisation, thanks to a value co-creation logic. In this value co-creation process, providers and clients became partners who share a final goal. This is possible through the interdisciplinary approach suggested by SS to promote the integration of resources in the system. On the other hand, VSA together with S-D logic and SS enables the building of a unified vision of complex objects

(such as community and home care services), thanks to different interpretative schemes coming from different perspectives (Barile, Eletti & Matteuzzi, 2013).

Thus, the convergence framework analyses community and home care as a complex system made up of different viable systems that survive in the context of reference by establishing relationship with supra-systems and by monitoring the evolution of interaction processes (Saviano et al., 2010).

In this way, also thanks to the evidence from the empirical case, which aims to prove our first interpretative hypothesis in practice, we define the criteria of effectiveness, efficiency, safety and sustainability to enable a convergence scheme from SS, VSA, and S-D logic in order to analyse complex systems, such as community and home care.

#### *2.3.1.1 The Viable Systems Approach*

This is the point where the Viable Systems Approach (VSA) (Barile, 2000, 2006, 2008, 2009; Golinelli, 2000, 2010, 2011; Barile & Saviano, 2011; Barile, et al., 2018) can make a fundamental contribution to the Service Science challenge 'to abstract' a service science from the study of service systems (Katzan, 2008; Maglio et al., 2009) starting from systems thinking and considering the Service Dominant logic theoretical constructs, which will be further analysed.

When we study systems, given that the aggregate of elements does not define the system itself, the starting question should be *"How does an aggregate of elements relative to which it is possible to identify functional relations, enable the emerging through dynamic interaction of a new autonomous entity that can be defined as system?"* (Barile & Saviano, 2011).

To answer this question, it is necessary to give, at first, two definitions:

- *"A system is a structure addressed to achieving a goal. The goal is reached through the interaction of the components in a series of relations (processes) respecting the rules"* (Barile, Saviano, 2011). The system is made of different components (operand and operant resources) different from each other, referred to a single objective, the survival of the system itself, defined by a single decision maker or a group;
- *"The structure is a set in which the elements are qualified as components recognized as having the capacity to contribute to perform specific functions (necessary to carrying out specific roles in the context of an emerging system). The components can be put in relation respecting specific constraints (rules)"* (ibidem). It could be seen as an environment in which the components are in relation to each other.

These two concepts are fundamental for our analysis. Together with two other relevant considerations:

- "*The concept of relation (structural) has a static nature and can be qualified as objective, requires an environment of reference and it is not dependent on what emerges from activating the relation itself.*
- *The concept of interaction (systemic) requires a context, has a dynamic nature and depends on the observer and what is observed from the observer's specific perspective of the investigation of reality"* (Barile & Saviano, 2011).

The structure-system paradigm allows us to analyse the complex healthcare ecosystem through a holistic view, defining which element could refer to the structure and which one to the system.

The complexity of healthcare derives, on the one hand, from its very nature as a dynamic system (Greenhalhg & Papoutsi, 2018), and, on the other hand, because we are dealing with health.

Furthermore, the very complex nature of community and home care systems could be well explained by the VSA. The VSA proposes a new interpretation scheme for complex phenomena, facilitating the comprehension of governance issues (Saviano et al., 2010).

| | **The 10 fundamental concepts (FCs) of VSA** |
|---|---|
| FC1 | Individuals, organisations, and social institutions are systems that consist of elements directed towards a specific goal. |
| FC2 | Every system (of level L) interacts with several supra-systems positioned at a higher level (L+1) and several sub-systems, located at a lower level (L-1). |
| FC3 | The interpretation of complex phenomena requires interdisciplinary approaches, and should synthesize both reductionist (analyzing elements and their relations) and holistic views (observing the whole). |
| FC4 | Systems are open to connection with other systems for the exchange of resources. A system boundary is an adaptive element, containing all the activities and resources needed for the system's evolution. |
| FC5 | Viable systems are autopoietic and self-organizing; that is, they are capable of regulating and stabilizing both internal conditions and the aforementioned boundary, maximizing internal possibilities in the face of external constraints. |

| | |
|---|---|
| FC6 | Every organisation is constituted by components that have specific roles, activities, and objectives within constraints, norms, and rules.<br>A system emerges from structure through the transformation of relations into dynamic interactions with sub- and supra-systems. |
| FC7 | Systems are consonant when the system's components are potentially compatible, whereas they are resonant when there is effective harmonic interaction among components. |
| FC8 | A system's viability is determined by its capability, over time, to develop harmonic behavior in sub-systems and supra-systems through consonant and resonant relationships. |
| FC9 | Business dynamics and viability require continuous structural and systemic changes focused to the alignment of internal structural potentialities with external systemic demands. |
| FC10 | Viable systems continuously align internal complexity with external complexity in order to better manage changes affecting its viable behaviour. Decision-makers within these cognitive processes are influenced by their beliefs, world-views, and information. |

*Table 2.1 - Source: Elaboration from Barile and Polese, 2010*

According to the third fundamental concept, to interpret complex phenomena, such as community and home care, an interdisciplinary approach that is able to synthetise both a reductionist and holistic view, is essential.

Putting fundamental concept number 6 into the healthcare context, community and home care are constituted by different components, such as patients, families, caregivers, doctors, nurses, and each of them has a specific role, activity, and objective inside the healthcare process. The structure of community and home care systems comes from the dynamic interaction between the different stakeholders involved, which are supra- and sub-systems.

According to Beer, an organisation is characterised by two areas: one for decision-making and the other one for decision implementation through an operative structure. The government ensures the survival of the system in a given context by developing conditions of *consonance* and *resonance* with the supra- and sub-systems involved (Golinelli, 2010). According to the second fundamental concept of VSA, *"Every system (of level L) interacts with several supra-systems positioned at a higher level (L+1) and several sub-systems, located at a lower level (L-1)".*

In the community and home care systems, in the ASLs it is the government that should ensure the condition of resonance to pursue *consonance*, which is the degree of integration within structures, and *resonance,* which consists of the system interaction capable of producing harmony between the parts. According to fundamental concept number 8, the viability of the system consists of its ability to develop this harmonic behaviour through consonance and resonance and to maintain it over time.

The supra system is the patient, who is the core of the value creation process, whilst the sub-systems are all the stakeholders involved in the healthcare process, such as patients' families, doctors, nurses, social workers, and so on.

To do so, it is necessary to classify the system's entities and to identify their interaction (Saviano et al., 2010), whilst also considering all the external influences. As previously stated, in community and home care models [5] the structural boundaries of the service are no longer clear, thus it becomes more difficult to understand the system's structure and which influences are internal and which are external. In our view, the capability of the system to create value is represented by its ability to satisfy the expectation of the relevant supra-systems (Saviano et al., 2010). When we talk about community and home care, we are mainly talking about patients with chronic illnesses. Within this context, the expectation of the supra-system (the patient) could lie in the effectiveness of the care and in an improvement of their state of health, thus preserving their dignity.

In this complex context, the definition of the interactions between the system and its supra- and sub-systems, together with its ability to align internal and external complexities enable it to manage changes affecting the viability of the system itself (FC10).

Through the VSA, it is possible to analyse healthcare systems by considering the degree of integration between the different stakeholders and the integration within different healthcare facilities, by then identifying the conditions for pursuing effectiveness, efficiency and sustainability in healthcare.

As we have already stated, the complexity of community and home care determines the need to manage variety and to avoid the 'silos' effect in the development and use of knowledge (Fig. 2.2).

[5] See paragraph 1.3, Figure 1.1.


*Figure 2.2 – Source: Elaboration from Barile and Polese, 2010*

The VSA provides general schemes for simplifying the framing and managing of variety, such as the T-shaped model. The key idea of the model is that T-Shaped people *"are deep problem solvers in their home discipline but also capable of interacting with and understanding specialists from a wide range of disciplines and functional areas"* (IfM & IBM, 2008).

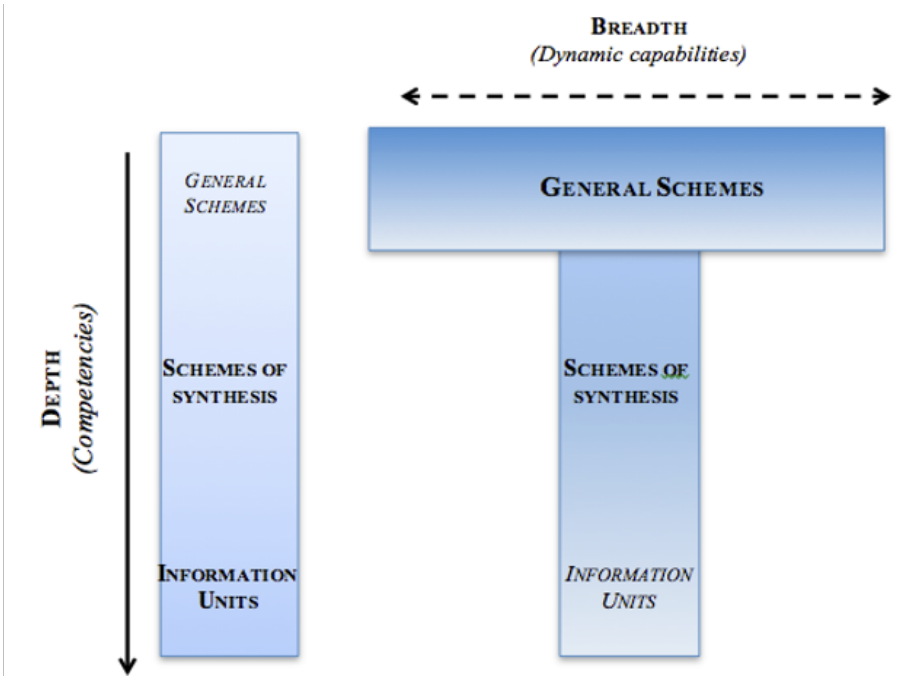


*Figure 2.3 – The VSA representation of the T-shaped model. Source: Barile & Saviano 2013: 51. Saviano et al. 2016: Elaboration from Spohrer, Gregory, Ren, 2010: 678.*

In the VSA, the key to building the T is developing the horizontal bar that is endowing knowledge with more general schemes, by using which it is possible to approach different disciplines, systems, and contexts. The VSA indicates that the way to build the horizontal bar is by adopting the systems thinking general scheme, avoiding the silos effect whilst integrating different healthcare disciplines, specialties, and professionals, and to do so, boundary crossing capabilities are necessary. Systems thinking provides us with such capabilities (Fig. 2.4).

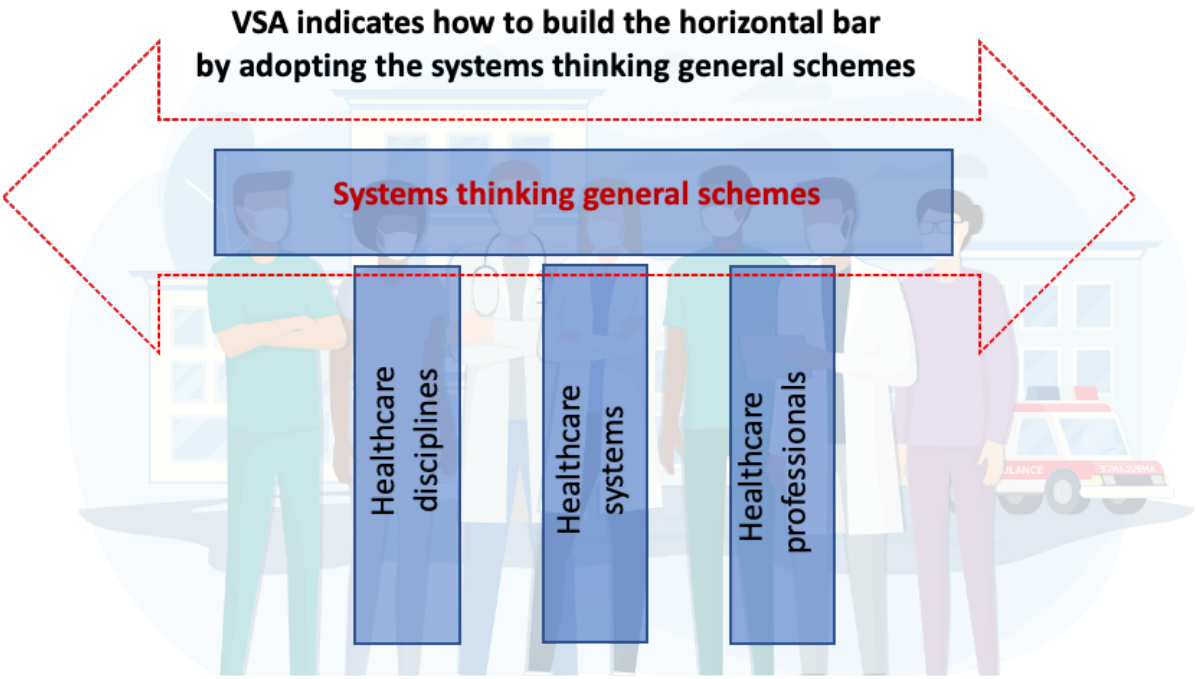


*Figure 2.4 – Saviano & Perillo, 2021b. The systems thinking contribution to the integration of healthcare knowledge*

### *2.3.1.2 The Service Science*

The approach used for this analysis is the Service Science (SS) approach. In this way it is possible to face the healthcare complexity, which poses issue for decision-making (Magliocca, Calabrese & Simone, 2016; Calabrese et al., 2018), in a relational perspective.

The principles of Service Science are (Spohrer & Kwan, 2008):

- resources;
- entities;
- access rights;
- value co-creation interactions;

- governance interactions;
- outcomes;
- stakeholders;
- measures;
- networks; and
- ecology.

Healthcare is service oriented by definition (Polese & Carrubbo, 2016). The application of principles and concepts proper to the SS approaches to articulated service structures, such as healthcare, identifies critical features and interesting new 'therapeutic' prospects for healthcare service systems in order to guarantee their viability (Saviano et al., 2010, ). We look at services as *"a provider/client relationship that creates and captures value"* and considers such relationship *"a kind of interaction between particular categories/entities aimed at specific value co-creation outcomes (win-win)"* (Spohrer & Kwan, 2008).

Service Science studies service systems, which are defined as a value co-creation configuration of people. This happens because clients, and thus patients, participate in the value chain providing labour, property, or information (Sampson & Froehle, 2009). This value co-creation process is determined by all the different stakeholders involved in healthcare processes, such as GPs, specialist doctors, nurses, health and social care workers, caregivers, pharmacists, and patients. The presence of all these stakeholders' inputs is a necessary and sufficient condition to defining a production process as a service process (Sampson & Froehle, 2009).

The service paradigm is based on an interpretation scheme of the interaction process emerging from the market exchange relation, characterised by an orientation towards the co-creation of value that is expression of a service perspective (Barile & Saviano, 2010).

Service is defined, in this way, as the application of an entity's knowledge to the benefit of another entity (Vargo & Lusch, 2004).

To understand service systems, it is necessary to approach and to consider service as a system (a whole) made up of interacting parts (IfM & IBM, 2008). The ability to understand complex service systems is hampered by the fragmentation of different disciplines (IfM & IBM, 2008) and due to a holistic standpoint.

In this work we will analyse healthcare services such as community and home care ones in a service view, investigating the relational perspective, thus the integration of health and social care stakeholders and the involvement of patients and family to enable the value co-creation process.

### *2.3.1.3 The Service Dominant Logic*

Service Science's multidisciplinary approach defines an innovative way to look at business production and business organisation, moving from a Good Dominant Logic toward a Service Dominant Logic (S-D logic). From this standpoint, service is the focal point of the system, focusing not on the services portfolio but on how to meet needs and to resolve relational issues affecting the viability of the system (Saviano et al., 2010).

While patients value health as an overall positive physical and psychological condition, the healthcare system cannot provide such a value. What can be provided are healthcare services, such as hospitalisation, out-patient care, primary care, community, and home care, and so on (Joiner & Lusch, 2016). According to Jiner & Lusch, even if there is a strong emphasis on patient-centred care, personalised medicine, patient engagement, patient literacy, this is not synonymous with being service-oriented. Indeed, the focus is still on the delivery of something rather than on the provision of a service. But this thing (such as, for example, medication) is just a distribution mechanism for service provision (fundamental premise number 3 – S-D logic).

The application of the S-D logic lens to healthcare is quite new despite healthcare being, by definition, service-oriented. However, it is possible to read about healthcare services under investigation in this work (community and home care) through the S-D logic axioms and fundamental premises. Vargo and Lusch (2004, 2006, 2008) proposed ten foundational premises and the axioms upon which their new paradigm of service dominant logic (S-D logic) was based in the contemporary service economy:

| S-D logic axioms and foundational premises | |
|---|---|
| Axiom 1/FP1 | Service is the fundamental basis of exchange |
| FP2 | Indirect exchange masks the fundamental basis of exchange |
| FP3 | Goods are a distribution mechanism for service provision |
| FP4 | Operant resources are the fundamental source of strategic benefit |
| FP5 | All economies are service economies |
| Axiom 2/FP6 | Value is co-created by multiple actors, always including the beneficiary |
| FP7 | Actors cannot deliver value but can participate in the creation and offering of value propositions |
| FP8 | A service-centered view is inherently customer oriented and relational |
| Axiom 3/FP9 | All social and economic actors are resource integrators |
| Axiom 4/FP10 | Value is always uniquely and phenomenologically determined by the beneficiary |
| Axiom 5/FP11 | Value co-creation is coordinated through actor-generated institutions and institutional arrangements |

*Figure 2.5 - Source: elaboration from Barile and Polese 2010*

Thus, we can use the five axioms and the foundational premises to read about community and home care.

At first, the core of healthcare, and subsequently of community and home care, is service. While in healthcare the focus is often on the product, in community and home care, the focus on the service aspects is more pronounced. We already talked about the relevance of the patients' role in the patient-centred care approach. The second axiom suggests the importance of the patient in the value co-creation process again. As a matter of fact, the health value chain is activated by the patient. Without them, the system doesn't exist. On the other hand, without the participation of the patient in community and home care services, it isn't possible to create value and ensure that treatment plans are effective (i.e. the patient ensures compliance with the care plan) (Axiom 2 and 4).

In this context, both the social and economic stakeholders are resource integrators. In community and home care, the resources integration happens in context, without strict boundaries and in an extended eco-system.

Thus, it is possible to understand the contribution that the Service Dominant Logic can provide in depicting the conditions of effectiveness, efficiency, safety and sustainability of such a complex service eco-system as community and home care.

#### *2.3.1.4 Integrating the three streams*

In the light of these frameworks, the answer to patients' needs are healthcare services that are characterised by effectiveness, efficiency and sustainability. The analysis not only considers the provider-client relationship (Kongstvedt, 2001), but also the value co-creation process in which patients and other stakeholders are involved (McColl-Kennedy et al., 2012).

In healthcare, in this provider-client relationship we have:

- providers: doctors, nurses, administrators, hospitals, clinics, etc,
- clients: patients, families, friends, etc.

They are both resource integrators that ensure the system viability. In the provider-client relationship, usually clients have a passive role. In community and home care models, as highlighted through the VSA and S-D logic lenses, the role of clients becomes crucial in the value co-creation process. The inclusion of clients/patients in the service process provides advantages in terms of cost reduction and effectiveness (McColl-Kennedy et al., 2009). The need for an efficient use of the limited available resources leads to an interpretation of the

concept of effectiveness which is linked to a perspective of sustainability (Saviano et al., 2010). Thus, again, we understand the importance of the criteria selected to design the interpretative framework.

The given conceptual framework stemming from the convergence between SS, VSA, and S-D logic aims to promote the condition of consonance and resonance in the healthcare system, as well as to use the fundamental premises, axioms, and foundational concepts of S-D logic and VSA to design a model in which it is possible to depict the effectiveness, efficiency, safety and sustainability features of healthcare services, and more precisely, community and home care, highlighting the relevance of preventative care and personalisation of treatment. In our INHS, which is a complex system, the decision-making power is distributed between central government and the regions. This framework allows us to understand how this complex system is evolving towards community and home care, preventative care and treatment customisation, thanks to a value co-creation logic. In this value co-creation process, providers and clients became partners who share a final goal. This is possible through the interdisciplinary approach suggested by SS in order to promote the integration of resources in the system. On the other hand, VSA together with S-D logic and SS enables the building of a unified vision of complex objects (such as community and home care services), thanks to different interpretative schemes coming from different perspectives (Barile, Eletti, & Matteuzzi, 2013).

Thus, the convergence framework analyses community and home care as a complex system made up of different viable systems that survive in the context of reference by establishing relationship with supra-systems and by monitoring the evolution of interaction processes (Saviano et al., 2010).

In this way, also thanks to the evidence from the empirical case, which aims to prove our first interpretative hypothesis in practice, we define the criteria of effectiveness, efficiency, safety and sustainability to enable a convergence scheme from SS, VSA, and S-D logic in order to analyse complex systems, such as community and home care.

### *2.3.2 A Systems based interpretative scheme: the structure-systems conceptual framework by Barile and Saviano (2011)*

These frameworks will converge into an integrated service and system framework.

Given the selected criteria and the perspective lenses, it will be possible to design a model which will be useful when it comes to analysing the complexity of healthcare.

The synergies between SS, VSA and S-D logic are the conceptual framework through which it is possible to study healthcare as a complex service system (Saviano, Bassano, & Calabrese, 2010) and healthcare services as an answer to patients' and other healthcare stakeholders' needs.

The VSA is an interpretative and governance methodology rooted in systems thinking and developed, in the field of the managerial studies, from the Stafford Beer's viable system model (VSM) to account for the management of any business or social organization as systemic entities aiming at surviving in their environment (Barile, 2008; Barile et al. 2012; Golinelli, 2010). The key proposal of the VSA is the structure-systems paradigm that highlights that systems are dynamic entities that emerge from structures based on the goals pursued by their governing actors. The system's structure is only a static representation useful to describe more or less objectively how the system is made; to understand how the system functions, however, it is necessary to read how the structural components interact on the basis of the goals pursued by the actors involved into the system's functioning.

An interpretative framework derived from the VSA structure-systems paradigm is proposed in Fig. 2.6 where it is used as a lens for comparing the two main healthcare approaches and settings under focus.

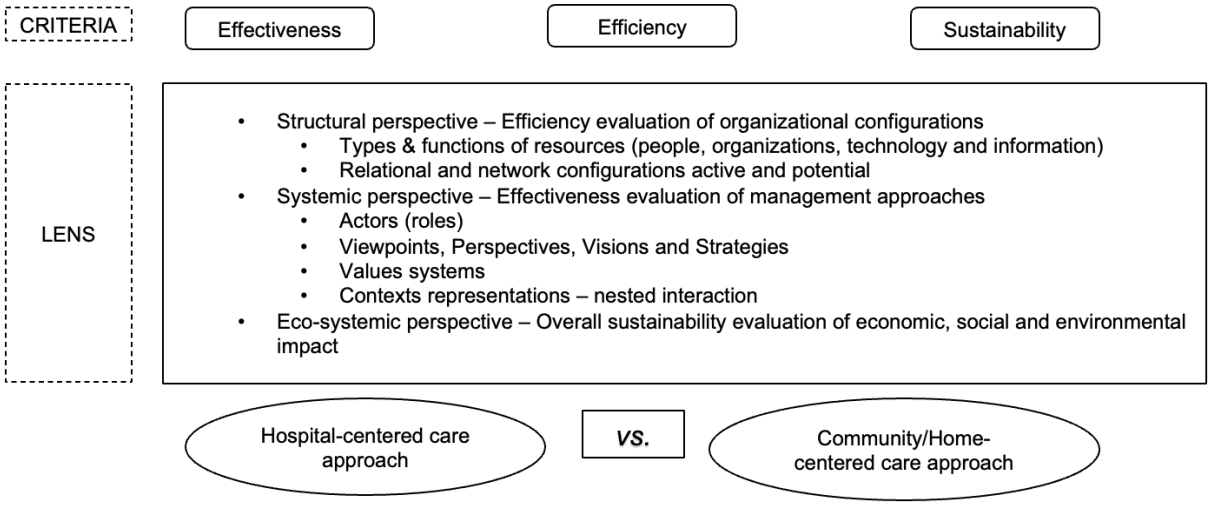


*Figure 2.6 – Saviano & Perillo, 2021a.*

This interpretative framework provides us with the criteria of effectiveness, efficiency, and sustainability and the healthcare services. The lens can benefit from integrations of key axioms and principles of VSA and S-D logic, though structural, systemic and eco-systemic perspectives. It this way, we may be able to investigate which model, patient centred or

community centred, proves to be more effective, efficient and sustainable, given the context conditions, as recommended by VSA.

### *2.3.3 A Service based interpretative scheme: the three-dimensional conceptual framework by Bolton et al. (2018)*

The customer (in our case patient) experience is fast changing due to technology innovation. Organizations responds to customers' need providing them experiences. Thus, the technological developments are changing the capabilities of service organizations and systems (Breidbach et al., 2018) and transforming the customer experience (Lemon, 2016; Van Doorn et al., 2017; Bolton et al., 2018). Furthermore, the society changes are accelerating the evolution of technologies, such as digital ones, affecting not only the digital realm, but also the interactions between people (systems), thus the social dimension, and the physical one. Thus, to analyse the impact of new technologies in reshaping service systems, we should consider changes not in one, rather in these three different dimensions.

The three dimensions conceptual framework developed by Bolton et al. (2018) is an analytical tool for understanding how the physical, digital, and social realms currently differentiate hospital and community care, and what occurs in these realms when digital care is introduced (Saviano, Perillo, & Fumai, 2021). The fourth revolution (technological revolution) is unprecedented in terms of its scale, speed, and complexity (Department for Business Energy and Industrial Strategy, 2017).

The three dimensions are represented through a cube, divided into octants, each of them characterized by low to high (Bolton et al., 2018):

- Complexity for the physical realm,
- Density for the digital real,
- Social presence for the social real.

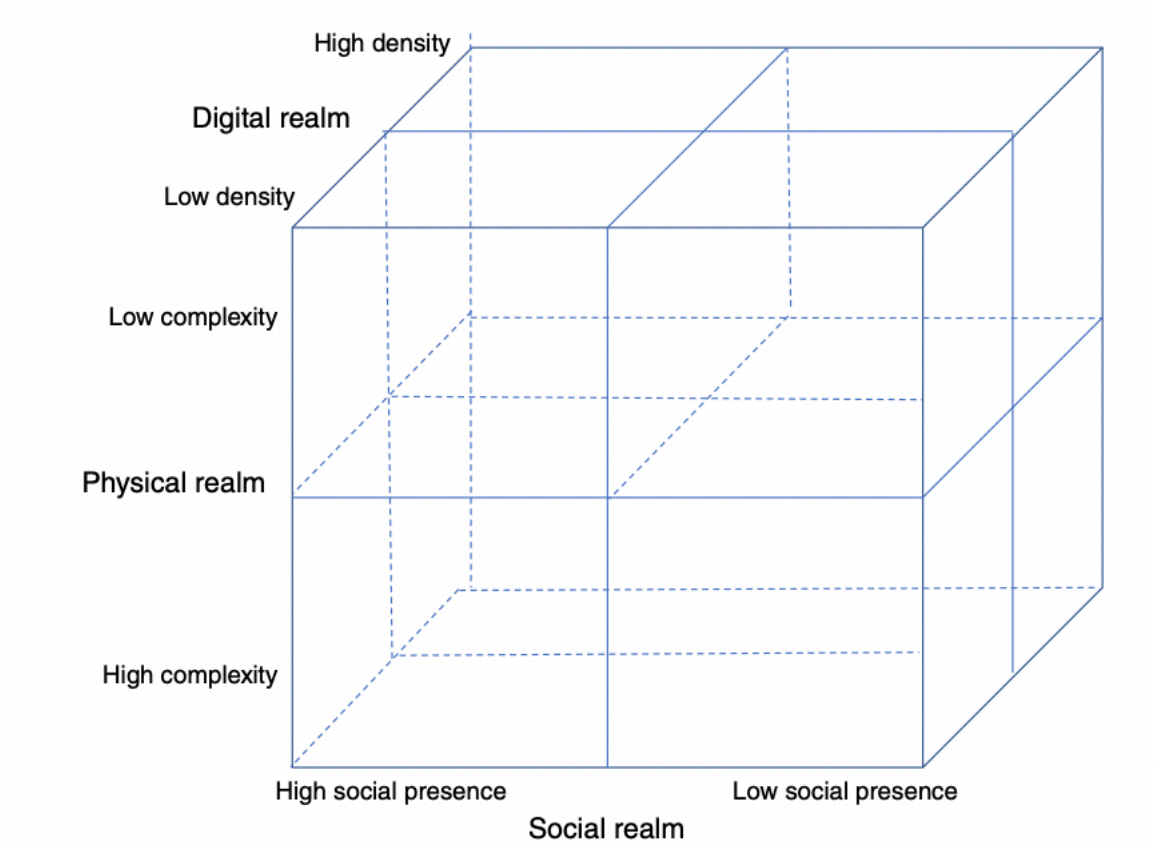


*Figure 2.7 - Depiction of the customer experience in digital, physical, and social realms with eight octants. Source: Bolton et al., 2018, p.779.*

The intersection of the three realms poses challenges for organizations as we move from low to high level of physical complexity, digital density, and social presence.

Understanding in which octant a services offering is allow us to understand the possible trajectories of evolution. At the same time, the possible trajectories of evolution highlight possible issues and the opportunities given by technology innovation (Quattrociocchi, Calabrese, Iandolo, Mercuri, 2022) implementation, giving us instrument to manage the lower rather higher level of complexity in the different realms.

*The digital realm*

The internet and all the technologies generated by its advent have, and still are, changed the way in which services are provided. Organizations, due to the higher complexity generated by new technology, need to leverage on digital instruments to achieve and to maintain competitive advantages (Bolton et al., 2018), responding to market dynamics effectively and in a timely manner (Leeflang, Verhoef, Dahlström & Freundt, 2014) (Kumar & Reinartz, 2016). Organizations, such as healthcare ones, are adopting more and more new technologies to face the issue of immediacy crisis and to meet new customer needs, providing immediate and

personalized solutions (Parise, Guinan, & Kafka, 2016). These new technologies allow providers to interact with customers. Thus, the digital realm sees an evolution from low to high digital density, due to these new technologies.

*The physical realm*

The physical realm, including equipment, spatial arrangement ambient and cultural elements, signs and symbols, influences the experience of the customer during the service encounters (Ballantyne & Nilsson, 2017). The physical dimension influences the interaction between customers and providers, thus the components of the physical realm are decisive to understand user experience, and technology is an increasing relevant component of this realm (Bolton et al., 2018). Thus, the physical dimension is characterized by ranging from low to high complexity. This is proven true also for healthcare services.

*The social realm*

Customer experience is built on interactions between different actors through different interfaces, which are increasingly non-human (De Keyser, Lemon, Klaus, & Keiningham, 2015) (Lemon & Verhoef, 2016).

Services, as we will see in the Service Dominant Logic paragraph, are made of interaction between providers and users addressed to value co-creation. In a digital context, the boundaries of this real become more and more weak, generating a sense of social presence (Bolton et al., 2018). This sense arises both in humans' interaction (physical context) and in human-non-human ones (virtual context). Thus, technologies adoption brings a shift from low to high social density.

## 2.4 Step 2: Mapping the literature through the VOSviewer software tool to further develop the interpretative hypotheses

Once the lenses of the synthesis framework are defined, deepening the literature will be necessary to understand the state of the art, to map the knowledge, and to develop the interpretative hypotheses.

The literature review will be run through a bibliometric analysis technique.

By employing a bibliometric literature review the study provides the potential to trace the evolution of the knowledge, finding the main topics, authors, sources, and most cited articles. Bibliometric analysis can be applied in all studies (Pritchard, 1969). It uses quantitative

methods to measure, track, and analyse scholarly literature (Roemer & Borchardt, 2015), through the analysis of a large volume of bibliographic material, such as keywords, references, and authors co-citation.

The method to run the bibliometric analysis will be the following:

- Use Scopus to search and download the literature database,
- Use VOSviewer software to run a three levels bibliometric analysis:
    1. Authors' keyword co-occurrence,
    2. References citation
    3. Bibliographic coupling

Due to our research question, which is the conditions of effectiveness, efficiency, sustainability and safety in moving toward community and home-care models, due to the necessity to analyse the enabling role of technology in such a transition, and in the light of PNRR focus on innovations and telemedicine as tools to achieve community and proximity care, the bibliometric literature review will be divided into three levels:

- The first level analysis will be related to teleassistance, which consists of providing care and assistance through telecommunication means;
- The second level analysis will be related to telerehabilitation, which is a branch of telemedicine, also. To understand the reason why we selected this specific branch, we should consider that one of the main focuses of the analysis run in the first chapter is the issue of assuring the continuity of and the accessibility to care. Rehabilitation is, by definition, a service provided in continuity of care. Thus, we want to investigate how is it possible to use technologies innovation to provide rehabilitative protocols in continuity of care not in hospitals or healthcare facilities, rather at a community and homebase level;
- The third level analysis will be run on technology acceptance model. As said in 2.4, technologies innovation are changing services provision and user experiences. Thus, in order to explore the interpretative hypotheses of a transition toward community and home care thanks to technologies, it will be necessary to understand how different actors react to innovations' implementations.

The bibliometric literature review will lead to the interpretative hypothesis further investigated through the case study empirical investigation.

## 2.5 Step 3: Discussing the developed interpretative hypotheses through a case study-based empirical exploration

The necessary premises for the empirical explorative investigation are that nowadays, the challenge is to assure high quality healthcare services which are all-the-more tailored to patients' needs. This coincides with a growing number of citizens whose needs and expectations are very different from those of previous generations.

The biggest pain points deal with the growing economic costs arising from illnesses and disability, the limited financial sustainability of current models and the shortage of healthcare practitioners (nurses, doctors, etc). In this landscape, the long-term care approaches and, in particular, the community and homecare services could represent an opportunity to rethink, redesign and transform the way in which healthcare services are provided. Balancing, also, the sustainability and equity expectations of healthcare (regional/provincial) Systems.

The focus on community care, on teleassistance and telerehabilitation, in particular, is due to the relevance of pursuing a specific healthcare approach which is also social. Exploiting the potential of community and home care services and equating these services to hospitalisation, it is possible to ensure an efficient use of resources, a reduction in hospitalisation cases (when not necessary), a more adequate customisation of treatments and, thus, more effective, and efficient hospitals operations. In this view, hospitals should be more and more specialised in intensive care for severe phases and clinical/diagnostic and therapeutic services with a high level of complexity.

Despite the recognised characteristics of effectiveness and efficiency of community and home care services, certain needs arise due to different regional provision practices, which consist of treatment inequalities across different regions, differences in services provided by different health authorities, and the level of concentration and variety in service provision throughout the country.

Thus, the potential role that community and home care services could play in a INHS governance reorganisation could be quite successful. This potential could be easily analysed in theory. The current Italian healthcare eco-systems do not present the necessary strategic approach to pursue community and home care across the entire country. This is due to the relevance of common and cooperative work by different stakeholders to achieve effective (and necessary) healthcare integration.

Thus, the expected contribution of implementing community and home care services with respect to effectiveness, efficiency, and sustainability, is linked to a deep rethinking of the INHS strategic direction and governance model, possibly through a systemic view.

To do so, technology offers us great tools to shift treatments from the hospital to a community-based provision. This is particularly true for long-term care. For these kinds of treatments there is a great potential that is yet to be fully explored with the opportunity to invest in advanced technological systems.

Teleassistance and telerehabilitation, thus, could represent a strategic area of action in which the potential of community care could be expressed, pursuing effectiveness, efficiency and sustainability through technological innovation and a rethinking of governance models (Quattrociocchi et al*.,* 2022).

Given that, to prove the interpretative hypotheses emerging from the literature review, a case-based study will be conducted as an empirical exploration functional to understand which are the factors that block rather allow the implementation of telerehabilitation on a community-based level. The exploration will bring to light the systemic and structural components of telerehabilitation, and, thus, the critical factors to implement it on a wider level.

The first stage of the empirical exploration consists of focus groups with the personnel of Nuova CTA involved in the implementation of telerehabilitation and virtual rehabilitation programs thanks to Khymeia technologies.

Than, the installation activities and the training one will be followed in order to understand how does the technologies work and which is the first evidence of the acceptance of them.

Thanks to the literature review, a first explorative questionnaire will be designed in order to be tested with the Nuova CTA staff. Thus, in-dept interviews with the personnel will be conducted in order to understand which is the real acceptance of the technologies.

The empirical explorative investigation is addressed to understand which could be a methodological effective path to follow in order to implement new tele rehabilitative technologies and which are the possible blockers and enablers.

The case study approach follows the basic guidelines used in literature for case studies (Crowe et al., 2011).

# CHAPTER III – FIRST INTERPRETATIVE HYPOTHESES IN THE LIGHT OF AN INTEGRATED SERVICE & SYSTEM VIEW (STEP 1)

## 3.1 Introductory theoretical overview

To develop the first interpretative hypothesis in the light of the VSA, SS and S-D logic, it is appropriate to preliminary linger the attention on a theoretical overview community and homecare-based models[6].

What emerges at first is the assumption that the ageing population is leading to an increase in chronic illness and an arising need for long term care (OECD, 2015). In addition, the prevalence of lifestyle-related chronic disease is steadily increasing, with the greatest increases occurring in younger individuals (Ford et al., 2013). Thus, the pattern of community care is expected to grow in the years to come (Low et al., 2011). Community and home care services could be the way to better address this long-term care. Home and community care services (otherwise known as domiciliary, non-medical home care or social care) aim to assist older people in living independently in their homes, and to maintain or enhance their quality-of-life for as long as possible (Low et al., 2011).

Community and home care services are provided by the INHS though LEAs, thanks to the healthcare integration in the provision of services. Due to the complexity of healthcare, the definition of a model for community and home care is challenging (McCann et al., 2005). The arising challenges, while designing community care models, deal with the need for healthcare resource and stakeholder integration, communication, and coordination, whilst also involving the patient, their family and the community.

Primary and community care are healthcare services provided not only in the community but also by the community, in a co-creation process (Iandolo et al., 2013), as a mean to enable

[6] To do so, a first literature overview is done, exporting data from Scopus through three different specific queries:
- community care: we started researching the query TITLE ("community" AND "care" AND "model"), selecting the subjects Business, Management and Accounting, Multidisciplinary, Economics, Econometrics and Finance. This query has been chosen in order to select only the works dealing with the actual models of community care services.
- homecare: the research was carried out through the query TITL-ABS-KEY ("homecare"), selecting the subjects Business, Management and Accounting, Multidisciplinary, Economics, Econometrics and Finance.
- community and home care: for this research it was difficult to identify a useful query of research. Investigating the two phenomena together in order to make a comparison between the two models, the query used to better fit the aim of the research was (TITLE-ABS-KEY (home AND based AND care) AND TITLE-ABS-KEY (community AND based AND care) AND TITLE-ABS-KEY (hospital AND care)), selecting the subjects Business, Management and Accounting, Economics, Econometrics and Finance.

health and social care integration (Ridolfi, 2011). The implementation of community care plans may lead to an enhancement of the effectiveness, efficiency, safety, and sustainability features of the service provision.

When it comes to homecare, we can define it as 'professional care provided at home to people with formally assessed needs', which includes rehabilitative, supportive, and technical nursing care, domestic aid and personal care, as well as respite care provided to informal caregivers (Genet et al., 2011), as defined by the LEAs. In Italy, in particular, there isn't a unique model for homecare services because of the high level of decentralisation and the differences in regional healthcare governance across the country (Le Bihan & Martin, 2006; Bos et al., 2007). Home care guarantees the continuity of care, minimising the need for the patient to seek out healthcare facilities, preventing hospitalisation and reducing the costs associated with it (Dhiliwal & Salins, 2015), and having a positive impact on patients' and their families' lives. To enable effective home care services, the implementation of new technologies is necessary (Charani et al., 2014), as is too the integration of different stakeholders and resources.

Speaking about a comparison between hospitalisation and community/home care services, what emerges from the literature is that the shift from the hospital towards the community and home care path enhance the patient experience (which is also thanks to the reduced anxiety and the perceived social support) with a possible improvement in the illness condition, and a reduction in usage costs (Markle-Reid et al., 2021). There is an increase in the literature about community and home care after the Covid-19 pandemic, which represented an accelerator of the transitional process from hospital-based care approaches toward community and home care ones. Indeed, an approach covering community- and home-based assistance is more effective than an approach exclusively based on hospitalisation (Cepiku et al., 2021).

Trying to understand the relation between hospitalisation, community/home care, and treatment customisation, Romàn et al. suggests that hospital and home care should be understood as a necessary conjunction to accomplish efficient personalised care (Romàn et al., 2009).

This overview is necessary to better understand the phenomenon of community and homecare to further derive a comparison between hospital-based provision and community and homecare one in the light of VSA structure/system framework.

## 3.2 A comparison between hospital and community/home care in the light of the VSA structure/system paradigm

Clearly, the community care approach shows higher potential in terms of effectiveness, efficiency, safety, and sustainability both at individual and collective level. On the other hand, the community care approach presents a higher level of complexity to manage. *"Using the structure-systems lens, we summarize the main aspects of the two care settings highlighting elements useful to detect the current relevance of the digital, physical, and social"* (Saviano, Perillo, & Fumai, 2022) dimensions (Table 3.1).

| *Service realms* | ***Hospital care*** | ***Community/home care*** |
|---|---|---|
| **Physical** | Hospitals are physical structures more 'visible' to the observers (focus is on the internal physical structure) | It is more difficult to 'see' the system's structure (focus is on the extended structure) |
| | More defined and 'visible' structural boundaries | Vanishing of the structural boundaries |
| | The resources are integrated internally to the service systems | The resources are integrated in service eco-systems |
| | Highly visible investment in health technology | Less visible investment in health technology |
| **Social** | Functions, roles, control mechanisms and responsibilities are more formally defined through rigid protocols | Functions, roles, control mechanisms and responsibilities are less formally defined and protocols are less rigid |
| | Limited involvement of social components | High involvement of social components |
| | Limited involvement of the patients' families | High involvement of the patients' families |
| **Digital** | Low use of digital technologies | Low use of digital technologies |
| **Overall complexity** | Lower, internal and structural complexity | Higher, extended, eco-systemic complexity |

*Table 3.1 – Comparing hospital and community/home care the light of structure/systems view. Source: adaptation from Saviano, Perillo & Fumai, 2022, p. 174.*

The pandemic affected healthcare both at a structural level and at a systemic one.

At the structural level, the previous management of healthcare facilities and the provision of services have been proven to be non-sufficient, facing the saturation of beds and resources, the scarcity of medical personnel, blocking the access to the facilities and the services and generating the necessity to move treatments from a hospital base to a community and homecare one.

On a systemic level, the way in which the interaction between the different actors of the healthcare ecosystem was not feasible, thus the previous face-to-face relationship between the healthcare providers and the patient had to change toward remote and non-face-to-face ones.

In this way Covid-19 highlighted the criticalities related to the shifting from a physical dimension of the therapy to a digital one, due to the necessity to move healthcare services from hospital to the community and home.

### 3.3 The complexity of reconciling the effectiveness, efficiency, safety and sustainability of the healthcare service from a systems perspective

Healthcare, as previously stated, is a complex system (no other system is more complex), meaning that its performance and behaviour changes over time and cannot be completely understood by simply knowing about components (Braithwaite, 2018). To grasp this complexity, it is necessary to approach the challenge of healthcare through multi-disciplinarity and the criteria of effectiveness, efficiency, safety, and sustainability could fit into an interpretive model that takes into account all of the system's elements.

Effectiveness is chosen as the first criteria because the aim of healthcare is to prevent and treat disease. As a matter of fact, the effectiveness of prevention means that disease won't occur, so the INHS goal is achieved, producing better health for all (Estae et al., 2014). Effectiveness is the first aim of healthcare providers, and it may be defined as the ability of an intervention to have a meaningful effect on patients' conditions with respect to desired results (Burches & Burches, 2020). To achieve effectiveness, it is necessary to do 'the right thing', making the right diagnosis, identifying any comorbidity, understanding the clinical picture and the patient's psychological condition, developing the right treatment protocol, involving the patient and caregivers in the decision-making process and in the treatment itself. Effectiveness can be seen and measured in observational studies whereby one phenomenon is analysed at a time, but it is not easy to measure it in real practice studies because there are interactions between different medications and comorbidities that could occur (Burches & Burches, 2020). It could be more appropriate in our analysis to look at effectiveness as the ability to produce a desired outcome in terms of a patient's health condition.

In terms of efficiency, as previously stated, it is important to consider the cost reduction strategy pursued in healthcare in recent decades. On the one hand, there is an increasing need for long-term care, due to the ageing population and the rising number of diagnosed chronic illnesses, and on the other hand, there is the constant reduction in expenditure. Due to the

scarcity of economic, technological, and human resources, an efficient usage of available resources is necessary in order to ensure each citizen is provided with the healthcare they need.

An initial question would investigate whether the pressures for cost containment may affect hospital performance in terms of population health status (Martini et al., 2014).

In recent decades, the rationing of resources and the maximisation of resources took place through the formalisation of procedures, codes, and protocols, towards an increasing focus on technical and economic performance (Saviano et al., 2018). This pathway had an impact on the ethical-value dimension of the relationship with healthcare users (Barile, 2012) and on the healthcare management approach.

In terms of safety, patients' safety emerged from the evolving complexity in healthcare systems and the resulting rise in patient harm in health care facilities (World Health Organization, 2019) and, more in general, in healthcare plans. Healthcare safety is essential in order to deliver a service with a high degree of quality. According to the WHO, health services should be effective, safe and people-centred. Key factors for ensuring the successful implementation of patient safety strategies are (World Health Organization, 2019):

- clear policies,
- leadership capacity,
- data to drive safety improvements,
- skilled healthcare professionals,
- and the effective involvement of patients in their care.

Ensuring safety while delivering healthcare services strengthens healthcare systems and enhances cost reduction (i.e. by reducing contraindications or complications of care plans).

The complexity of healthcare makes safety a dynamic concept and a systems problem (Taylor & Hignett, 2021).

The last identified criterion is sustainability. Sustainability in healthcare is a broad concept.

Healthcare organisations have a dual function: on the one hand, they deal with health, which is one of the most important sectors of public interest, thus the effectiveness of the service is the main priority; on the other hand, they work as another kind of organisation that must achieve a monetary, financial, and economic balance in order to survive (Saviano et al., 2018). Furthermore, the focus should be wider, considering the overall social and environmental impact of healthcare activities. Sustainability is crucial when dealing with healthcare because it enables the shift from short-term towards long-term viability and survival.

According to Saviano et al., *"Healthcare organisations carry out a variety of activities that are combined in diverse operational processes, finding their productive purpose and mission*

*not only in meeting the needs of individual patients but also in ensuring the overall well-being of populations. Hence, incorporating sustainability into the management and control system is fundamental and also useful in the pursuit of change and innovation".*

In addition to the complexity of the system, we need to consider the variability of human population and to quantify human complexity (Naylor & Chen, 2010).

Now, in the light of the interpretative framework developed, we can summarize the main insights in the next Figure 3.2:

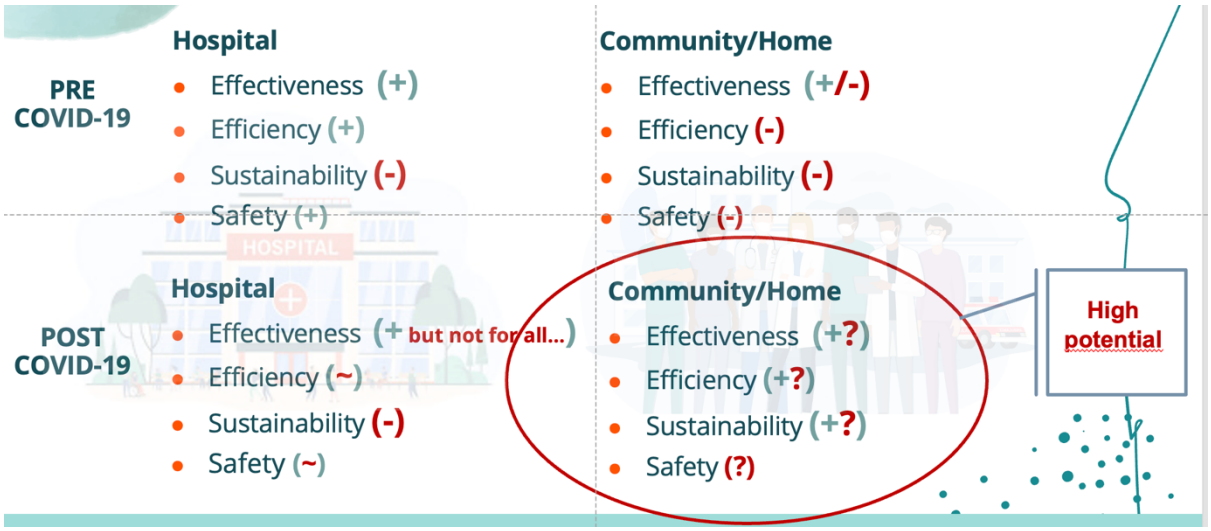


*Figure 3.2 – Saviano & Perillo, 2021b*

Taken also in account that INHS services offering, made of preventative, curative and rehabilitative care, answer to patients' needs, which are, from a patient point of view, characterized by psycho-social (good health and well-being), biological (recovery from an illness) and functional (functional recovery) aspects (Saviano, Bassano, Calabrese, 2010), due to the very nature and dynamics of the needs.

Analysing the evolution of healthcare needs through a curve, it is not disputed that when a health problem occurs, it presents a peak until a diagnosis is obtained (intensive phase of curative care). The curve starts to decline only when the treatment has started (extensive phase of curative care), even if it will involve long term assistance, i.e. rehabilitative care. The evolution of the patient needs is represented in the Saviano et al. 'Healthcare Need Curve' (Figure 3.3):

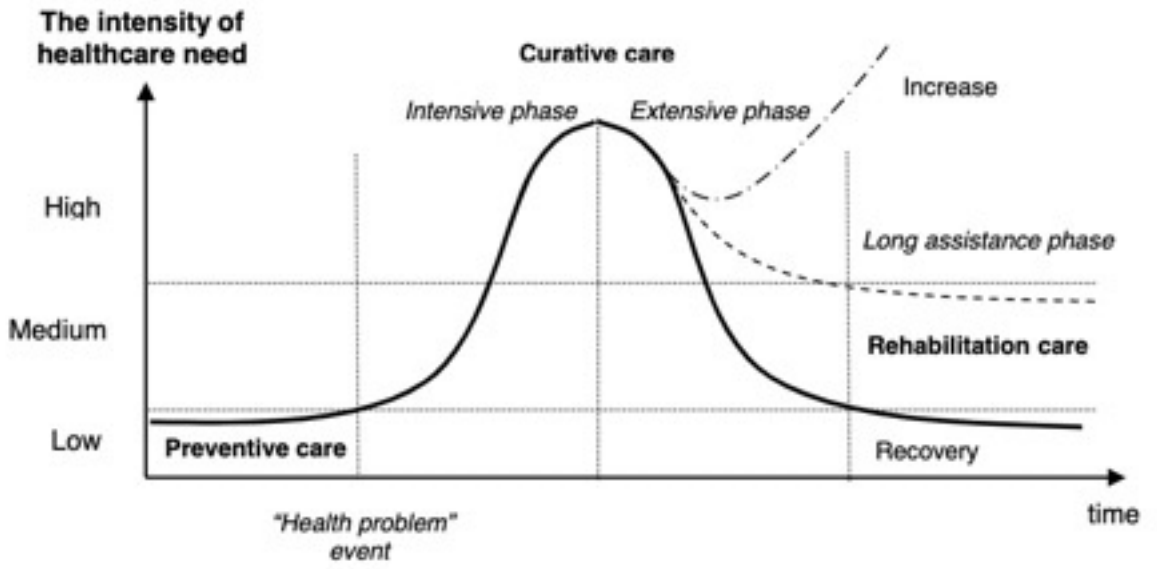


*Figure 3.3 – The healthcare Need Curve - Source: Saviano et al. 2010, p.51.*

Thus, the intensity of healthcare need is:

- high for curative care;
- middle for long assistance care (rehabilitative care);
- low for preventative care (ibidem).

Thus, the patient acts in relation to the intensity of their needs related to his/her condition.

The lenses used to design this model come from the System Thinking, Service Science (SS), Viable Systems Approach (VSA) and the Service Dominant Logic (S-D logic).

Given this complex context, we will try to read healthcare through the selected lens of framing to define a first theoretical and interpretative hypothesis. To do so, we must initially revise the LEA framework in the light of VSA, SS and S-D logic.

## 3.4 A revised systems view of the LEAs framework

It is possible to revise LEAs on the base of the distinction between services provided in hospitals and services provided through community and home care (Saviano, 2014). As regards community and home care, there are services that may seem to be substituted even if this is not the case, differing not only on the base of the facilities and the organisation of the service, but also in substantial terms too.

Given all these differences between different services in community and home care provision, it is possible to organise the healthcare services on the base of their individual costs with respect with the selected LEAs.

A proposed scheme of synthesis is the Healthcare Service Matrix proposed by Saviano in 2007.

Through this matrix, it is possible to classify healthcare services based on:

- intensity of the patient's need for care:
    1. low – prevention need;
    2. middle – rehabilitation need;
    3. high – need for care.
- Level of healthcare service costs for the ASL:
    1. Low – district level;
    2. Middle – home care services;
    3. High – hospital level.

This matrix defines macro groups of healthcare services, as shown in the figure below.

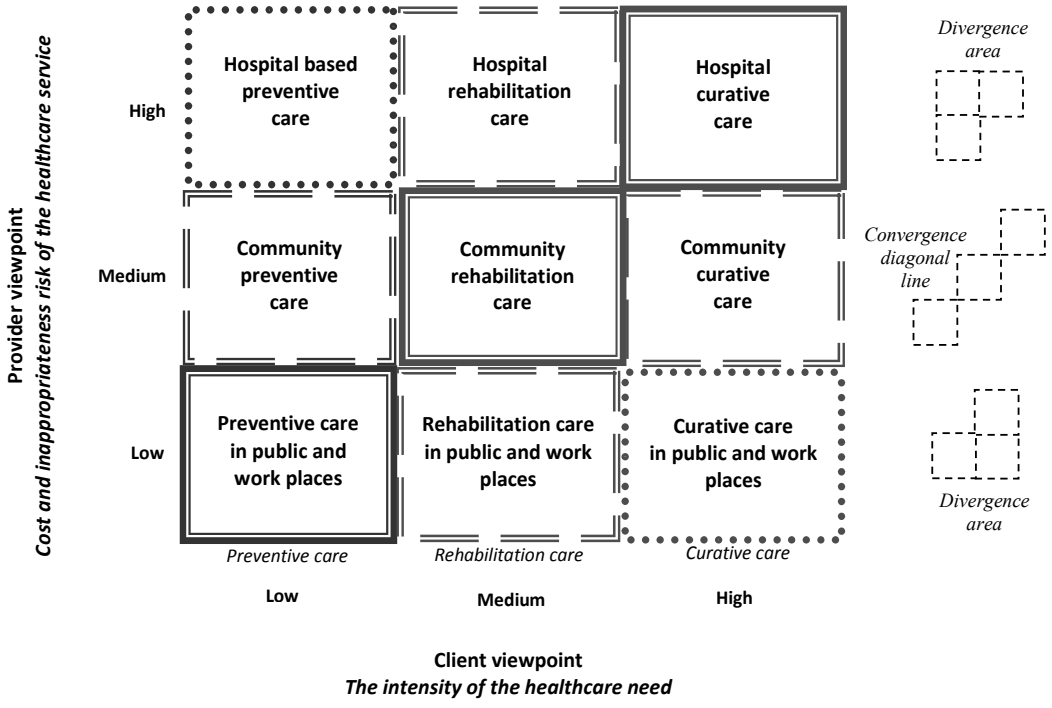


*Figure 3.4 – The healthcare service matrix - Source: Saviano et al. 2010 and Saviano, 2012, p.52.*

From this representation, it is possible to also highlight the risk for inappropriateness, which is useful for achieving the cost containment objective.

It is also possible to understand that there are some divergence areas between hospitalisation and community/home care, which depend on the role of the patient and their involvement in the healthcare process, on the hospital, community and home care's structure, on the integration of resources in these three services, and so on.

### 3.5 Shifting from hospitals to community and home care in the light of Bolton et al. cube: the key role of (digital) technology

The lenses of VSA, SS and S-D logic allow us to generate a primary hypothesis from the comparison of Covid-19 evidence of hospitalisation and community/home care models.

In our first interpretative hypothesis shifting from hospitals to community/home from a structure-system view (Barile & Saviano, 2008; Saviano et al., 2010):

- In hospital care, the structural (physical) aspects of the service appear dominant compared to the systemic ones. The physical structure of hospitals is more visible to the observer; thus, the focus is on the internal structure with more visible and defined structural boundaries. The resources are internally integrated, the investment in technologies is visible, and the focus is basically on the illness. The human resources involved are mainly the healthcare personnel (i.e doctors and nurses), with a limited involvement of social components and families. Furthermore, the functions, roles, control mechanisms and responsibilities are more formally defined due to the rigid protocols that are in place.
- In community/home care the systemic (dynamic) aspects of the service appear dominant compared to the structural ones. The system's structure is more difficult to depict because the focus is on the extended structure, in which the structural boundaries are no longer apparent. The resource integration happens in context, leading to the definition of healthcare service eco-systems. The focus isn't on the illness anymore, but it moves onto the patient in a patient-centred care view. In this context, social components and families are involved in the healthcare value co-creation processes (Zhang et al., 2015). In this model, functions, roles, control mechanisms and responsibilities are less formally defined, originating from less rigid protocols.

Thus, in the hospitalisation model there are effective hospital-centred conditions, while in community/home care models there are effective patient-centred conditions.

From this perspective, whilst on the one hand the management of variety appears less complex in hospital care, it appears to be more complex in community/home care (Rouse, 2008).

| | Hospital care | Community/Home care |
|---|---|---|
| | **Traditional System** | **Complex Adaptive System** |
| Roles | Management | Leadership |
| Methods | Command and control | Incentives and inhibitions |
| Measurement | Activities | Outcomes |
| Focus | Efficiency | Agility |
| Relationships | Contractual | Personal commitments |
| Network | Hierarchy | Heterarchy |
| Design | Organizational design | Self-organization |

*Figure 3.5 – Saviano & Perillo, 2021b. Complexity factors and governance approaches to healthcare (adapted from Rouse 2008).*

Together with a higher degree of complexity, community/home care also presents a high potential that is yet to be fully explored (Polese et al., 2018; Badr & Gardner, 2021).

Thus, this shifting toward community care could be analysed through the previously selected criteria. There could be an improvement, which will be investigated in the empirical analysis, in:

- Effectiveness (e.g. involving further dimensions of satisfaction, involving social workers and families);
- Efficiency (e.g. relying on an enriched set of resources and on an extended context);
- Safety (e.g. using technology to ensure the safety of the treatment);
- Sustainability (e.g. decongesting hospitals).

The arising question is related to how it is possible to manage this higher complexity of community and home care in order to exploit its full potential. According to Barile, complexity is not in the observed object, thus in the community and home care models itself, but in the observer eye (Barile, 2009), thus on how we look at it. We need to use simple underlying rules to frame the complexity of community and home care, just like for all the complex phenomena (Wolfram, 2008).

In order to provide simple schemes to frame community and home care complexity, we use the interpretative framework of the VSA through:

- Structural perspective – Efficiency evaluation of organisational configurations:
    1. Types & functions of resources (people, organisations, technology and information);
    2. Relational and network configuration active and potential;
- Systemic perspective – Effectiveness evaluation of management approaches:
    1. Stakeholders (roles);
    2. Viewpoints, perspectives, visions and strategies;
    3. Value systems;
    4. Context representations – nested interaction;
- Eco-systemic perspective – Overall sustainability evaluation of the economic, social and environmental impact.

Given these premises, it is possible to say that digital technologies are transforming service ecosystems (Iandolo & Cosimato, 2019). The increasing use of digital technologies in healthcare service ecosystem (e.g., artificial intelligence AI, Big Data, 3D printing, virtual reality VR, etc.) will make the physical dimension (realm) and its constraints less relevant (Saviano, Perillo & Fumai, 2022). On the other hand, users, both patients and healthcare services' providers, should value the benefits coming from new technologies implementation (Aquino, 2018).

The point is that *"people and organizations must shape the role that technology plays in the design and delivery of the customer experience. Interconnections between devices and platforms have the potential to create complex service systems that – if they fail – could have far-reaching consequences that could be very destructive"* (Bolton et al., 2018).

Given the comparison between hospital care and community care, the different octants defined by the three-dimensional Bolton framework and the way in which we can interpret these three dimensions through VSA, it is possible to state that (Saviano, Perillo & Fumai, 2022):

- *"Hospital care is characterized by service settings in which the physical realm shows low complexity, the social realm low social presence, and the digital realm low density";*
- *"Community care is characterized by service settings in which the physical realm shows high complexity, the social realm high social presence, and the digital realm low density".*

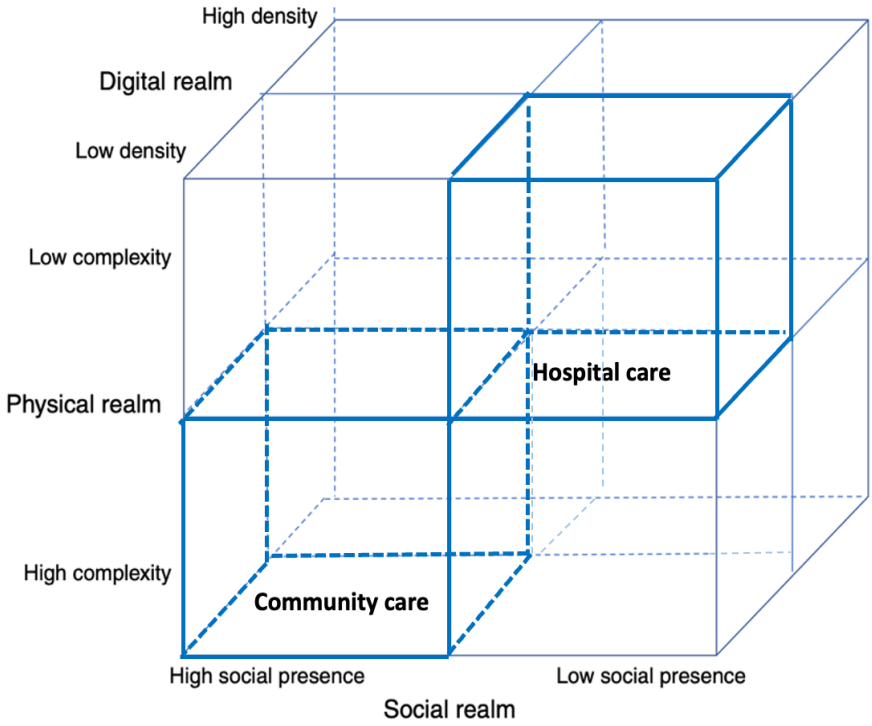


*Figure 3.6 – Hospital and community care in the three-dimensional conceptual framework. Source: Saviano, Perillo & Fumai, 2022, p.175.*

From this standpoint, it is possible to shift the focus on teleassistance and telerehabilitation services using the Bolton cube.

Rehabilitation is delivered both:

- In hospital setting: characterized by low social presence, low physical complexity, and low digital density,
- In community setting: characterized by high social presence, high physical complexity, and low digital density.

To assure continuity of care, integrating rehabilitative care in the community and home settings, and introducing digital technology, telerehabilitation programs can be offered to patients.

In telerehabilitation the physical dimension of the treatment, thus, meets the digital one, through telecommunication-based practices and new technology. Covid-19 pandemics accelerated the transition from traditional rehabilitative protocols to telerehabilitation ones, due to the necessity of dehospitalization.

Telerehabilitation potential could lead to a shift from hospital to community/home settings, leveraging the high digital density that allow the integration of the three realms (Saviano, Perillo & Fumai, 2022).

The transition toward telerehabilitation happens through three possible trajectories:

- *"From high to low physical complexity (compared to community settings): which is due to the possibility to provide rehabilitation services not in presence, enhancing remote service at the same time allowing 24/7 access to telerehabilitation services.*
- *From low to high social presence (compared to hospital settings): through the digital technologies the higher social presence could increase the value co-created and reduce to organizational risk.*
- *From low to high digital intensity (compared to both hospital and community settings): due to more intense use of digital technologies that support the delivery of service"* (Saviano, Perillo, & Fumai, 2022).

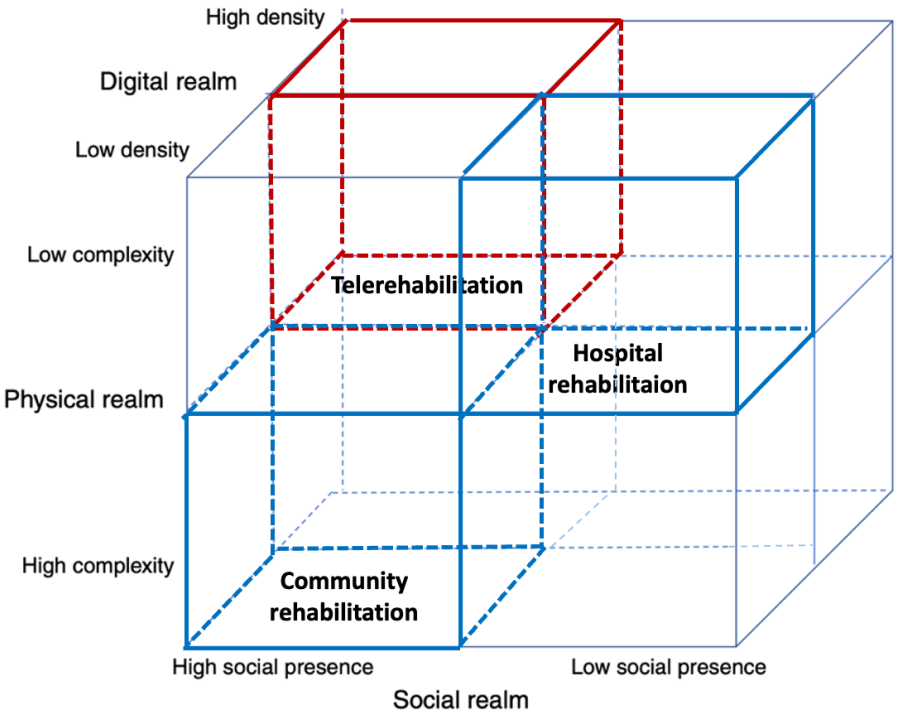


*Figure 3.7 – Telerehabilitation as a shift from hospital to enhanced community/home care. Source: Saviano, Perillo & Fumai, 2022, p.176.*

This shift could reduce the physical complexity making more effective the management of the different actors involved in the care process. It also represents a challenge for digital technology, which is the key driver of such a shift, and which is necessary to promote

telerehabilitation programs. The higher digital density comes together with the issue of the technology acceptance. Literature reports various issue generated by the transition to non-in-person rehabilitative programs (Hilty & al., 2013).

Thus, it is necessary to understand the technology acceptance of new technology for teleassistance and telerehabilitation, which will be analysed in chapter 4.

Analysing this shift also through VSA and Information Variety Model (IVM) (Barile, 2009; Barile, Saviano & Polese, 2014) together with the framework provided by Bolton et al. allow us to consider physical and digital dimension not separately but rather as integrated. Barile's VSA IVM gives a further framework to recognize the relevance of the cognitive dimension in service integration (Saviano, Perillo & Fumai, 2022). Through these last two frameworks the appropriate service system arises. While on the one hand the systemic aspects impact the effectiveness of telerehabilitative protocols, on the other hand they are perceived through the information variety of the involved different actors. Thus, telerehabilitation should be seen as a service system in which the three dimensions are integrated. In this view, the structures are necessary condition for telemedicine implementation and the emergence of the system, while the effectiveness depends on the systems functioning and different actors' interaction. The outcome of telerehabilitative protocols is affected, thus, not by the physicality of the interaction, but by the cognitive alignment of the interacting actors (Saviano, Perillo & Fumai, 2022).

Both the physical and digital realms of different healthcare setting influence interaction not because of their objective physical or non-physical nature. Rather, being cognitive aligned allow different actors to successfully interact, whether the interaction is face-to-face or not.

The evolution from traditional rehabilitative protocols toward telerehabilitative ones, thus, is not based on a physical/digital dilemma. Instead, the key to interpret the evolution toward new technology and, thus, a higher digital density, is focusing the attention on the cognitive dimension of the interaction.

## 3.6 Main conceptual findings: the critical role of (digital) technology acceptance in the path towards the future community and home care

The transition towards a healthcare evolution, as anticipated by the analysis carried out until now, comes together with the implementation of technology.

The advent of new technologies is changing the services setting and offering.

Furthermore, the pandemic represented a strategic challenge and was associated with disruption of both the demand and capacity (Heinonen & Strandvik, 2020). Thus, healthcare providers and organisations have to face new needs and the challenge of a necessary evolution. *"Service innovation to improve existing services and to create new ones"* (Heinonen & Strandvik, 2020) represents one of the possible ways of coping with the crisis generated by the pandemic.

The imposed service innovation for healthcare is represented through the implementation of new (digital) technologies, redesigning and reshaping the service offering in order to meet the new care needs of the population. This evolution will force healthcare organisations to rethink and reshape the way in which services are provided.

The role of (digital) technology in this evolution is relevant not only in the way in which it affects management, but also because it improves networks and the value creation process within them (Santovito, 2015).

The key point that we should consider is that different actors are and will be involved in the process, interacting with each other. Thus, the critical factor to pursuing such a transition towards a community-based healthcare provision will be the actors are involved themselves. The capability of patients, healthcare practitioners and decision makers to accept new (digital) technologies will be decisive when it comes to pursuing healthcare service innovation.

While on a structural level, due also to the PNRR and the guidelines of the future healthcare, the implementation of new technologies could seem feasible, and the path for a higher digital density will require a disruptive transformation on a systemic level.

The way in which we are used to seeing the interaction between the actors involved in the healthcare process, indeed, will need to change. This means that a community-based care model will only be feasible if actors will be ready and will stive to understand the relevance of new technologies, accepting them and reconfiguring the way in which they perceive healthcare services. Thus, while at a macro level the problem is the implementation of new technologies to pursue community and proximity care (structural level), on a micro and specific level (systemic level), the key problem to address is the acceptance of the technology.

Further investigation, indeed, will focus its attention of this, trying to define what could be an effective path towards a healthcare model characterised by a higher digital density.

# CHAPTER IV – MAPPING THE LITERATURE TO DEVELOP THE INTERPRETATIVE HYPOTHESES (STEP 2)

The literature review will be divided into three streams to map the knowledge related to the research question and to develop the interpretative hypotheses.

The first stream of research is related to Teleassistance. The reason behind this stream of literature review is that the analysis of possible path to shift from hospitalization toward proximity and community care comes through remote assistance, given the necessary evolution toward community and proximity healthcare services, the elderly of population and the increase of chronic illnesses, and also due to the relevance given to digitalization and telemedicine inside the PNRR, the research wants to investigate how is it possible to provide remote healthcare services, assisting patients in the long run, thus we search for teleassistance. Thus, we want to understand which patients could be treated in remote, for which kind of pathologies remote assistance proves to be effective, which are the tools used to pursue such a path and the other relevant factors. Running a review on telemedicine, the first tried stream of research, the query led to too many results, not enabling a proper map of knowledge. Thus, in order to better understand the state of the art related to remote assistance, a query on teleassistance has been chosen.

The second stream of literature review is run on telerehabilitation, being rehabilitation one of the most relevant treatment carried on in post hospitalization and across the territory (community and home care based). Also considering the Curve or Care Need, discussed in 3.2, rehabilitation strongly burdens he INHS, being characterized by medium to high intensity of care in the long run, through this stream of literature review we want to assess how remote treatment is pursued for such healthcare services. In this phase we assess the state of the art related to community and home care rehabilitative treatment provided through telerehabilitation.

The emerging issue is that, being remote assistance and telerehabilitation possible though technology, the acceptance of technologies could represent a decisive factor to make these therapy paths effective. Thus, the necessity to assess technology acceptance does arise. Because of that, the last stream of literature review deals with TAM, mapping the existing models for healthcare and trying to investigate the most relevant blocking and enabling factors to make telerehabilitation effective, efficient, and sustainable.

These three streams of literature review are necessary to map the knowledge to prepare the empirical explorative investigation and to derive a model of synthesis for it.

To map knowledge of such wide topics, a tool is necessary. The chosen one is VOSviewer, which allow to map knowledge and to grasp the complexity of teleassistance, telerehabilitation and technology acceptance.

The tool comes with some limitation, due to the loss of information while using bibliometric analysis. A price which has to be paid in order to map such wide knowledge fields.

## 4.1 The methodology of the literature review: mapping three literature streams using the VOSviewer software tool

The three-level analysis will be carried out using the VOSviewer open source software from the Centre for Science and Technology Studies at the University of Leida.

VOSviewer is a software tool for constructing and visualising bibliometric maps and networks. The software is able to process journals, research or individual publications, and the maps can be constructed based on citations, bibliographic coupling, co-citations or co-authorship relations. *"VOSviewer also offers a text mining functionality that can be used to construct and visualise co-occurrence networks of important terms extracted from a body of scientific literature"* (VOSviewer). Data can be imported from different databases. The selected one for this research is Scopus.

- The software uses the following techniques:
- An advanced layout and clustering technique;
- A natural language processing technique;
- Bibliometric network creation.

Once the database of articles has been extracted from Scopus, the resulting CSV is uploaded onto the software.

The phases of the analyses are:

- author keyword co-citation in order to identify the most frequent keywords;
- co-citation was used (Small, 1973) to identify historical references and the origin and evolution of different ideas. This made it possible to identify the authors that contributed the most to the evolution of this area of study;
- bibliographic coupling (Kessler, 1963) in order to group the works into clusters identified according to common references.

The main contributions from the software are:

- Keyword co-occurrence led to the identification of the character of each cluster in terms of disciplinary pertinence. For this analysis a thesaurus is also used. It is a functionality that allows us to export the keywords from the map in Excel in order to manually substitute and aggregate the repeated ones (i.e., “healthcare” and “health care”). The aim of the thesaurus is to exclude general terms which are inconsistent for the research and to link a series of words expressing the same concept. Once the Excel is ready, the file is uploaded onto VOSviewer to complete the map with the finalisation of the keyword clustering;
- Co-citation aims to identify the main historical references for each cluster. Once the map is generated, we searched for the obtained works in order to investigate the main pillars of the knowledge and their character (Iandolo et al., 2021);
- Bibliographic coupling combines two different functionalities: creation of distance-based maps and clustering. In order to obtain the map and to improve visualisation, some parameters have to be selected. When setting the parameters, the clustering appears. The size of network nodes indicates the relative importance of each document, and the thickness of the links indicates the strength of the link between two nodes. The distance between two nodes indicates the degree of similarity of each document in terms of the bibliographic references cited (Iandolo et al., 2021).

This process of analysis will be followed for each level of the literature review.

### 4.2 First stream: an overview on teleassistance as an evolutive trend of healthcare

The first stream of the literature review is conducted through the Scopus database. To understand the main perspectives and focal points that characterise the interest that scholars have shown in teleassistance and telerehabilitation, all the different subject areas are selected. The type of documents selected were articles, reviews, books, sections in books and conference papers. The time span chosen covers the last ten years. These criteria are the same for all the queries. The bibliometric analysis process is also the same for each level of the literature review.

A first query used was for teleassistance and yielded a total of 388 works[7]. We used the software to run a bibliometric analysis.

7 The query used was as follows: ( TITLE-ABS-KEY ( *teleassistance* ) OR TITLE-ABS-KEY ( *tele-assistance* ) OR TITLE-ABS-KEY ( *tele AND assistance* ) ) AND ( LIMIT-TO ( PUBYEAR , 2023 ) OR LIMIT-TO ( PUBYEAR , 2022 ) OR LIMIT-TO ( PUBYEAR , 2021 ) OR LIMIT-TO ( PUBYEAR ,

The first analysis run through VOSviewer is the author keyword co-occurrence. This analysis is carried out to identify which keywords are more frequently used in the literature.

By setting the threshold of a minimum number of occurrences of a keyword equal to 3 and a minimum cluster size equal to 10, and using a thesaurus to eliminate the repeated keywords, there are 4 resulting clusters (Figure 4.1).

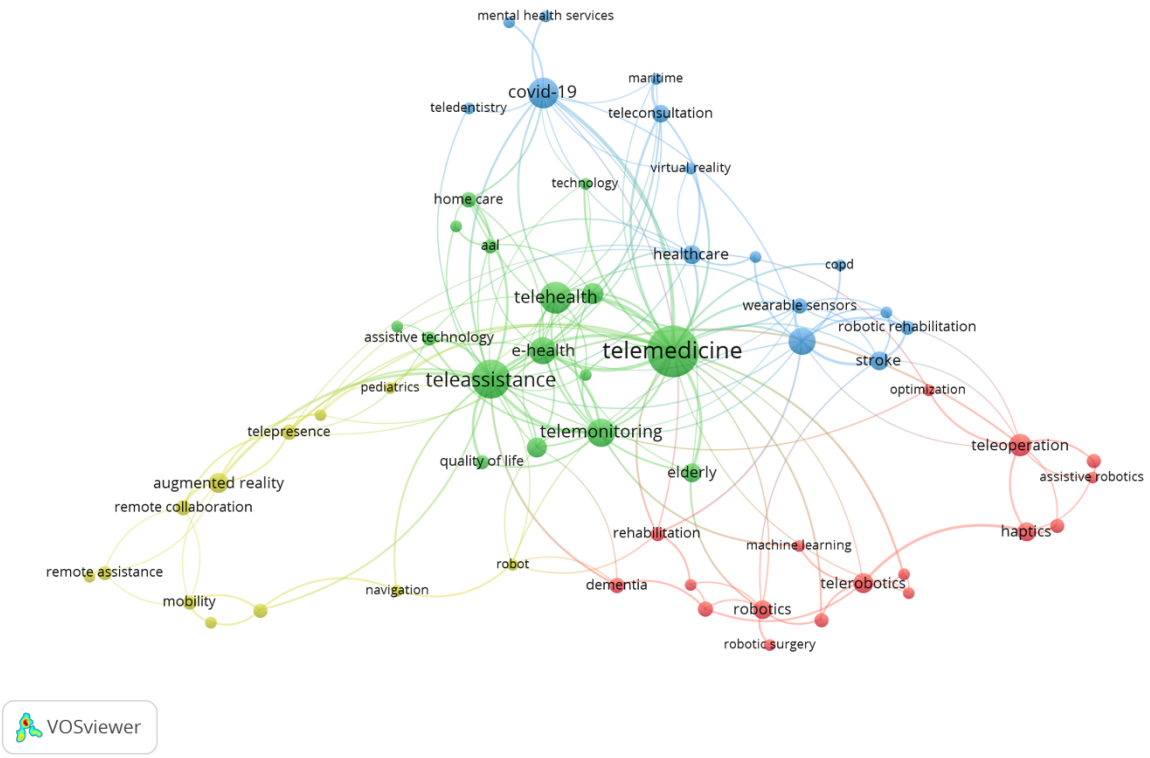


*Figure 4.1 - Vosviewer keyword co-occurrence map for the teleassistance query - network visualisation*

We have four clusters:

- In the first cluster, in red with 17 items, the most relevant and cited keywords are: teleoperation, assisted robotics, robotics, robotic surgery, telerobotics, machine learning, optimisation, haptics, dementia. Thus, it is possible to understand that the whole cluster is mainly based on robotic aspects. Robotics are mainly used as tools for

2020 ) OR LIMIT-TO ( PUBYEAR , 2019 ) OR LIMIT-TO ( PUBYEAR , 2018 ) OR LIMIT-TO ( PUBYEAR , 2017 ) OR LIMIT-TO ( PUBYEAR , 2016 ) OR LIMIT-TO ( PUBYEAR , 2015 ) OR LIMIT-TO ( PUBYEAR , 2014 ) ) AND ( LIMIT-TO ( DOCTYPE , “ar” ) OR LIMIT-TO ( DOCTYPE , “cp” ) OR LIMIT-TO ( DOCTYPE , “ch” ) OR LIMIT-TO ( DOCTYPE , “re” ) OR LIMIT-TO ( DOCTYPE , “bk” )

improving medical practices, such as assisted medical imaging (Salcudean, Morandi, Black, & Navab, 2022). The role of such technologies is to help practitioners and to manage improved complexity (Naughton & Hauser, 2022). Thus, it is possible to understand that these works are mainly related to technologies as new possibilities for managing medical treatments and to support practitioners.

- In the second cluster, in green with 16 items, the most relevant and cited keywords are: telemedicine, telehealth, teleassistance, telemonitoring, e-health, assistive technology, elderly, homecare, paediatrics and quality of life. Thus, this cluster is much more focused on the core topics of telemedicine and its declination (such as teleassistance). Teleassistance is used for telemonitoring (Urquijo et al., 2022) thanks to e-health technologies, which do not come without their issues, such as difficulties in accepting the technology due to the so-called digital divide and the lack of digital skills (Runfola, Fantola, Pintus, Iafrancesco, & Moroni, 2020).
- In the third cluster, in blue with 15 items, the most important and cited keywords are: covid-19, teleconsultation, wearable sensors, stroke, robotic rehabilitation, mental health services and healthcare. It is not disputed that this cluster, due to the overlay visualisation[8], contains some of the most recent works relating to the Covid-19 pandemic. Teleassistance has proved to be an effective tool in chronic disease management, which has seen an increase in health emergencies due to the Covid-19 pandemic (Parise et al., 2021). The changes regarding patient healthcare, including hospital admissions due to the pandemic, highlighted the relevance of the role of new technologies for vulnerable patients (Matamala-Gomez et al., 2021) and for people with chronic diseases.
- In the fourth cluster, in yellow with 12 items, the most important and cited keywords are: remote assistance, remote collaboration, telepresence, augmented reality, navigation, robot, mobility and paediatrics. This highlight something quite interesting: while we often think about chronic patients as the elderly, also children could present care needs characterized by middle to high intensity of care needs in the middle/long run. The cluster is made of some of the oldest work produced by the query. In terms of remote assistance, it is not disputed that telepresence and remote control, thanks to both everyday technologies (i.e. smartphones) and robots/sensors, allow healthcare

[8] Available in appendix I "Vosviewer keyword co-occurrence map for the teleassistance query - overlay visualisation"

practitioners to communicate better not only with the patient but also with other practitioners, sharing data and working together in order to prepare and manage the treatment or the surgery (Singh et al., 2020), whilst also enabling older people and vulnerable patients to stay at home for as long as possible (De Cola et al., 2020).

The co-citation and bibliographic coupling maps and networks were constructed using a fractional counting methodology, which assigns equal weight to all the co-authors in the same publication. In this way, the total weight of the single publication is always equal to 1.

The method of co-citations is aimed at establishing the frequency with which 'n' ($n \geq 1$) publications of previous literature are cited together in 'm' ($m \geq 2$) subsequent contributions. The network of co-citation is built with a threshold set at 5 and a minimum cluster size set at 5. In this way, we have 5 different clusters.

Co-citation has been used to identify the most relevant contributions to the literature, which are analysed below, grouped according to the clusters and on the basis of the weights associated to each author and the strength of the links between different authors highlighted through the VOSviewer map. The threshold is set at 2, providing just the one cluster of 14 authors (Figure 4.2).

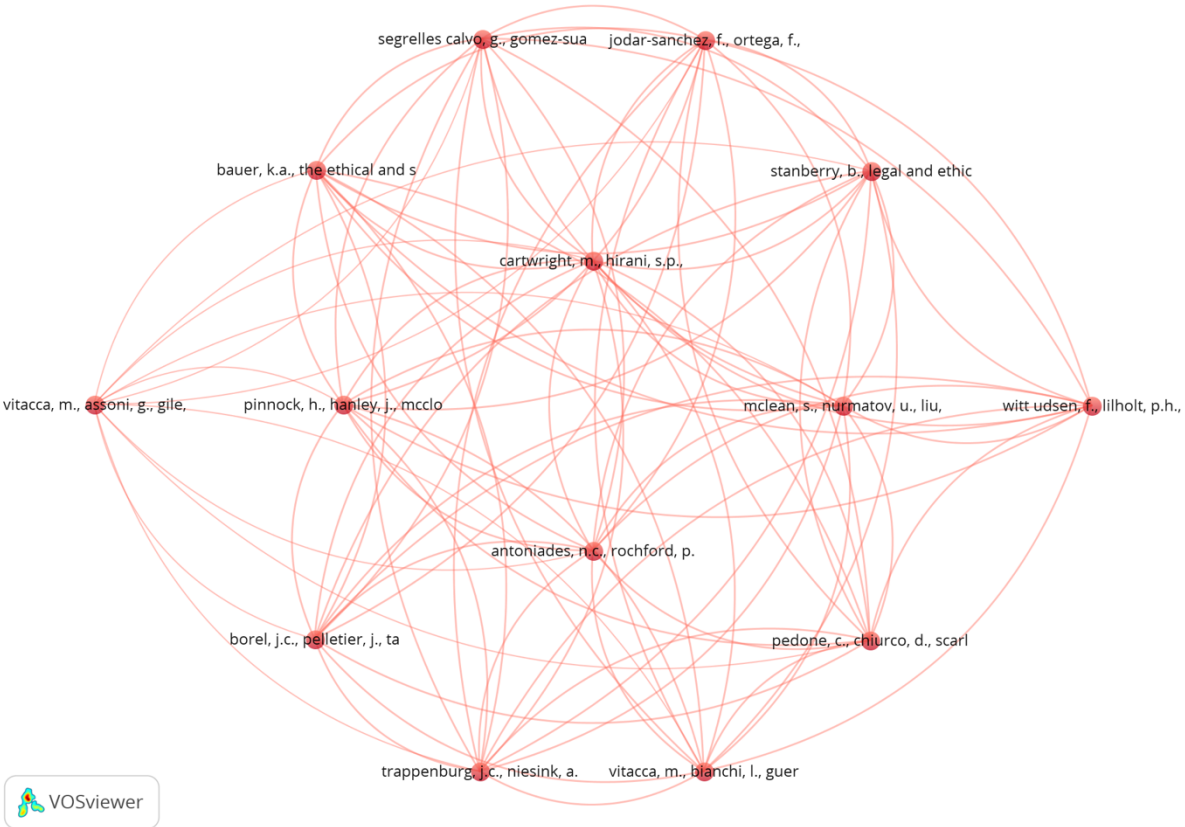


*Figure 4.2 – Vosviewer references co-citation map for the teleassistance query - network visualisation*

The congruity of the citations highlights the following key points:

- Teleassistance is used as a tool to manage chronic patients from home (Vitacca, Comini, Tabaglio, Platto, & Gazzi, 2019) changing the clinical practice for such chronic pathologies (Vitacca, Montini, & Comini, 2018), as well as showing a heavy influence on cost-effectiveness (Witt Udsen, Lilholt, Hejlesen, & Ehler, 2017).
- Such teleassistance treatments involve personalised healthcare at distance and could have the potential to improve care for chronic patients (McLean et al., 2012).
- The growth of home-based telemedicine practices leads to considerations related to the quality of life for patients, caregivers and family, and the relationship between the providers and the patient (Bauer, 2000).

Then, we move onto bibliographic coupling, which aims to identify the publications that cite the same previous works. The network of bibliographic coupling is built with a threshold set at 5 and a minimum cluster size set at 10. In this way, we have 5 different clusters. The threshold is set at 5 and the minimum cluster size is set at 10 (Figure 4.3).

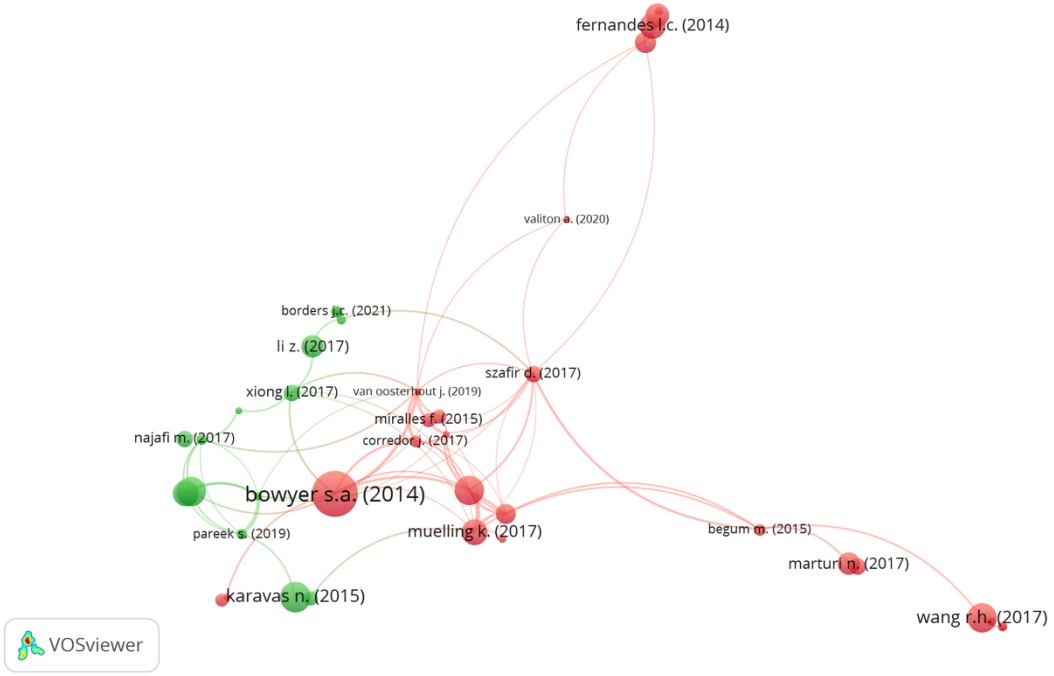


*Figure 4.3 – Vosviewer documents' bibliographic coupling map for the teleassistance query - network visualisation*

The first cluster in red is made up of 26 items. In this cluster, the main authors are Bowyer et al., Wang et al., Muelling et al., and Javdani et al. Some works will not be taken into account because they deal with teleassistance in fields besides healthcare.

Examples of teleassistance are robotised telescography systems that help with the medical expert diagnosis (Kupra, Folio, Novales, Vieyres, & Li, 2014), high-level control algorithms used to assist a human in man-machine collaborative manipulation tasks (Bowyer, Davies, & Rodriguez y Baena), augmented reality to enhance remote collaboration, which is a promising approach for enabling gestures (Guverich, Lanir, & Cohen, 2015) and it can also provide effective and customisable support (Lamberti et al., 2014). Human-robot collaboration studies all the interactions between humans and robots sharing a workspace, such as shared autonomy and shared control teleoperation in which robots help to achieve the user's goal (Javdani, Admoni, Pellegrinelli, Srinivasa, & Bagnell, 2018).

What has emerged is that there are limits and constraints in using such teleassistance technologies (Bowyer, Davies, & Rodriguez y Baena) on the one hand, and challenges in implementation, such as latency, low-dimensional user commands, asymmetric control inputs (Muelling K. et al., 2017), communication delays, and environmental differences (Tanwani & Calinon, 2017) on the other.

The relevance of teleassistance consists of the possibility of moving the patient from hospital to their home using technologies that could be used by people in need at home (Miralles et al., 2015). Examples of this are assistive robots that help older adults with dementia to carry out daily activities or social needs, thanks to human-robot dialogue which is able to solve ambiguity in a team that works in a dynamic environment (Begum, Huq, Wang, & Mihailidis, 2015). In this context, contemplating a future with assistive robots, considering opportunities with assistive robots, and reflecting on implications for social relationships are the themes that summarise responses to robot interaction (Wang, Sudhama, Begum, Huq, & Mihailidis, 2016).

The second cluster in green is made up of 14 items. The most relevant authors of the cluster are Karavas N., Sivan M., Li Z., Najafi M., and Xiong L..

In this cluster, it is possible to collect examples of the use of home-based robotic technologies that could offer the possibility for rehabilitation exercises from home (Sivan et al., 2014). Teleassistance is also helpful in reducing the risk of infections while taking care of patients (Xiong, Chng, Chui, Yu, & Li, 2017) and in reducing the exposure of healthcare operators like, for example, during interventional radiological operations (Xiong, Chng, Chui, Yu, & Li, 2017). Other examples of robotic teleassistance is reported to play a relevant role in the development of children's cognitive and perceptual skills for children with severe physical

impairment in order to give them the opportunity to play and participate in motion learning (Najafi, Sharifi, Adams, & Tavakoli, 2017). In these papers, human-robot interaction is crucial when it comes to allowing therapist assistance (ibidem). Teleassistance robots could also help practitioners in reducing the magnitudes of the required force and lowering their intervention (Sharifi, Behzadipuor, Salarieh, & Tavakoli, 2020). Long term disability and motor deficits are treated through rehabilitation, the conventional paradigms of which are primarily hospital-centric involving different practitioners, such as occupational therapists and doctors, and then home-based (Pareek, Manjunath, Esfahani, & Kesavadas, 2019). The issue of most home-based rehabilitation is the lack of a human chaperone that can regulate the therapy by ensuring patient motivation and active participation towards the prescribed exercises (i.e. a caregiver) (ibidem). The telepresence mobile robots could provide benefits for tele-homecare, biometric data monitoring and assistance in everyday life, activities that are possible only if the patient or the caregiver are able to manage the technology and willing to be involved (Laniel et al., 2017).

### 4.3 Second stream: a focus on telerehabilitation as a community-based healthcare service

The second stream of analysis of the literature review is related to telerehabilitation according to the process already used in the first level: using the Scopus database, a bibliometric analysis is carried out using the VOSviewer software. The limits used in the query are the same as the previous step in the literature review.

The query related to telerehabilitation has produced 2950 documents[9], upon which the bibliometric analysis was carried out.

The first analysis was carried out on the author keywords using a fractional method and with a threshold set at 10, whilst using the thesaurus to merge the same keywords. By setting the minimum cluster size to 10, the map generated (Figure 4.4) is made up of five different clusters:

[9] The used query is: ( TITLE-ABS-KEY ( *telerehabilitation* ) OR TITLE-ABS-KEY ( *tele-rehabilitation* ) OR TITLE-ABS-KEY ( *tele AND rehabilitation* ) OR TITLE-ABS-KEY ( *telerehab* ) OR TITLE-ABS-KEY ( *tele-rehab* ) OR TITLE-ABS-KEY ( *tele AND rehab* ) ) AND ( LIMIT-TO ( DOCTYPE , "ar" ) OR LIMIT-TO ( DOCTYPE , "cp" ) OR LIMIT-TO ( DOCTYPE , "ch" ) OR LIMIT-TO ( DOCTYPE , "re" ) OR LIMIT-TO ( DOCTYPE , "bk" ) ) AND ( LIMIT-TO ( PUBYEAR , 2023 ) OR LIMIT-TO ( PUBYEAR , 2022 ) OR LIMIT-TO ( PUBYEAR , 2021 ) OR LIMIT-TO ( PUBYEAR , 2020 ) OR LIMIT-TO ( PUBYEAR , 2019 ) OR LIMIT-TO ( PUBYEAR , 2018 ) OR LIMIT-TO ( PUBYEAR , 2017 ) OR LIMIT-TO ( PUBYEAR , 2016 ) OR LIMIT-TO ( PUBYEAR , 2015 ) OR LIMIT-TO ( PUBYEAR , 2014 ) )

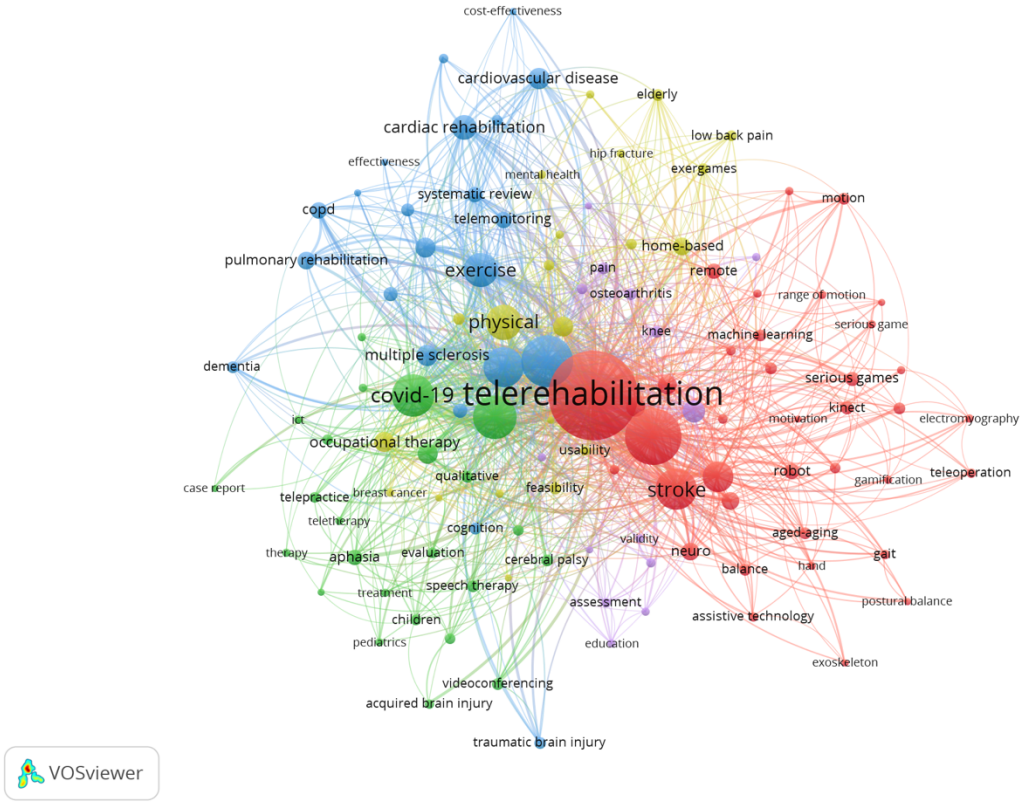


*Figure 4.4 – Vosviewer keyword co-occurrence map for the telerehabilitation query - network visualisation*

- In the first cluster, in red with 37 items, the most relevant and cited keywords are: telerehabilitation (the most cited keyword), stroke, rehabilitation, Parkinson's, neuro, activity of daily life, teleoperation, robot, mobile, augmented reality, virtual rehabilitation, artificial intelligence, machine learning, gamification/serious games, wearable sensors. Home-based rehabilitative treatments have proven to be non-inferior and valid, achieving improvements in the quality of life for the patient (Theodoros, Hill, & Russell, 2016).
- In the second cluster, in green with 24 items, the most relevant and cited keywords are: telehealth and Covid-19 as the two most cited keywords of the cluster. Then, we have technology, teletherapy, telepractice, video conferencing, therapy, speech therapy, aphasia, cerebral palsy and acquired brain injury. Technologies used in telehealth protocols allow for disparities in the access to care to be reduced (Chirra et al., 2019). To do so, it should be acceptable, doable and effective to overcome the limits related to treatment acceptability (Wainer & Ingersoll, 2015). Also here, as in the first stream of research, we do find keywords and, thus, works, related to children

therapy, confirming the previously made consideration about the relevance of remote protocols also for pediatric patients.

- In the third cluster, in blue with 22 items, the most important and cited keywords are: telemedicine, e-health, exercise, cardiovascular disease, cardiac rehabilitation and pulmonary rehabilitation, exercise, chronic, telemonitoring, and self-management. The opportunities arising from electronic health technologies deal with improvements in access to and in the quality of routine healthcare services (Marzinіak et al., 2018) and long-term rehabilitation (Taylor & Griffin, 2014).
- In the fourth cluster, in yellow with 21 items, the most important and cited keywords are: physical, quality of life, disability, older adults/elderly, home-based, anxiety and depression.
- In the fifth cluster, in purple with 14 items, the most relevant and cited keywords are: physiotherapy, pain, education, training, assessment.

By carrying out the reference co-citation analysis through VOSviewer with a fractional counting, and setting the threshold to 10 and the minimum cluster size to 6, we obtain the following map (Figure 4.5) with two clusters.

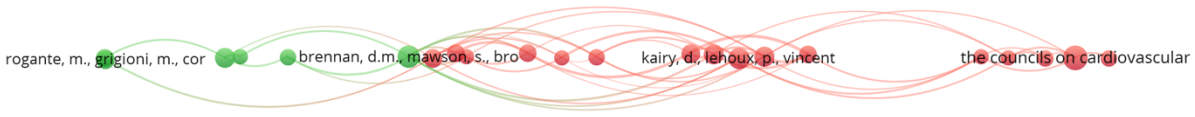


*Figure 4.5 – Vosviewer reference co-citation map for the telerehabilitation query - network visualisation*

This analysis allows us to understand the seminal contributions that the pillars of the telerehabilitation literature have been built on.

In the first cluster, in red with 16 cited works, articles are related to telerehabilitation in use. The main points of such works are:

- Advances in technologies and telecommunication have boosted telerehabilitation, in other words, the possibility to deliver rehabilitation via the internet with an increased intensity of care (Agostini et al., 2015).
- Taking into account that telerehabilitation protocols (i.e. using virtual reality) are not more beneficial than conventional therapy approaches (Tousignant et al., 2011; Laver

et al., 2017; Piotrowicz et al., 2020), it could be useful to supplement traditional rehabilitative protocols, improving patients' ability to perform a self-care and social role. It is indeed relevant not only to assure the effectiveness of the care, but also to achieve positive psychological outcomes (Kairy, Lehoux, Vincent & Visintin, 2009). The potential of such protocols consists in being an alternative or a supplement to face-to-face rehabilitation, reducing costs, increasing geographic accessibility (Winters, 2002), and acting as a mechanism to extend limited resources (McCue, Fairman & Pramuka, 2010).

- One of the possible issues consists of the limited resources available for home rehabilitation (Chumbler et al., 2012).
- Telerehabilitation allows patient-tailored protocols, in which telemonitoring activities (Russel et al., 2013) come together with a relevant tele-coaching role played by healthcare practitioners in order to achieve long-term effectiveness (Frederix et al., 2015).
- The most effective strategies involve non only the patient, but the caregiver too (Langhorne, Bernhardt & Kwakkel, 2011).

The second cluster, in green with 6 cited works, highlights that:

- The aim of these protocols is to provide equitable access to rehabilitation services (Russel, 2007).
- In telerehabilitation, there is a core importance of the human factors and the user-centric design of the implemented technologies, which is also related to self-care and self-management (Brennan, Mawson & Brownsell, 2009).
- There is a lack of evidence that could support decision and poly-makers in the adoption of telerehabilitation technologies and a lack of standardisation too (Rogante, Grigioni, Cordella & Giacomozzi, 2010).

From this standpoint, it is necessary to delve deeper into the topic, carrying out a bibliographic coupling analysis on documents through Vosviewer on the same database of works. The threshold is set at 50, the minimum cluster size at 10 and with a fractional counting.

The resulting map presents six clusters (Figure 4.6):

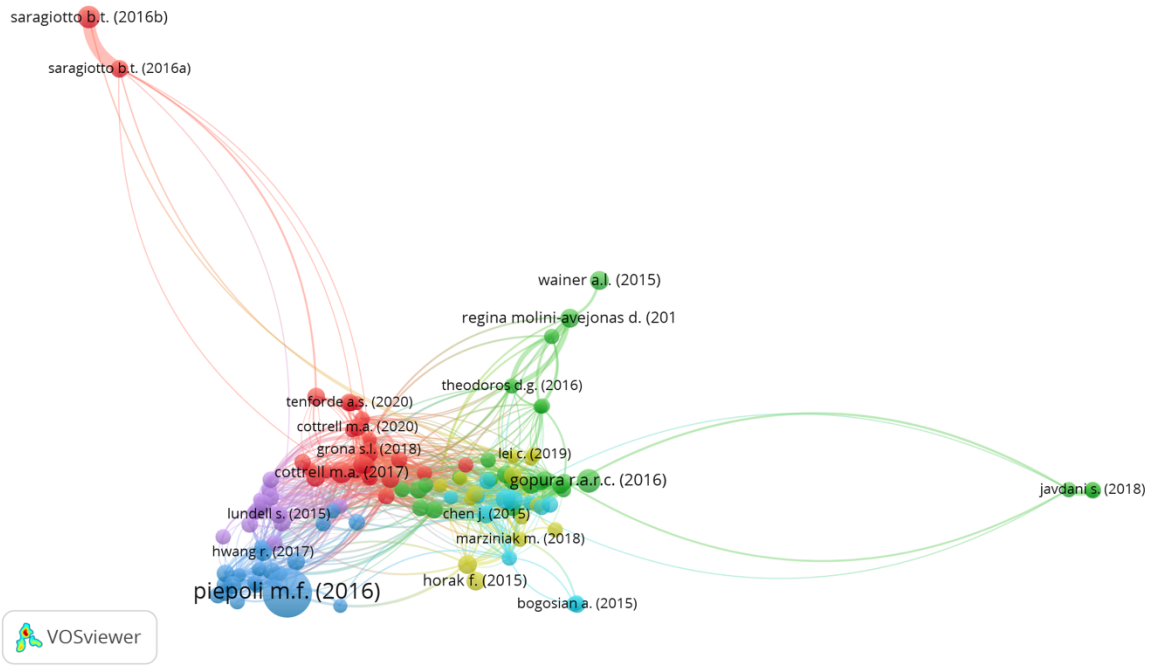


*Figure 4.6 – Vosviewer documents' bibliographic coupling map for the telerehabilitation query - network visualisation*

The first cluster, in red, contains 28 works. The usage of technology for remote rehabilitation has grown exponentially during recent years, with a wide range of services, such as evaluation, assessment, monitoring, prevention, intervention, supervision, education, consultation and coaching (DeFre Galea, 2019) .The opportunities that arise from technological advantages using non-face-to-face treatments allow patient to have fewer barriers, such as distance – access to rehabilitation services and workers could be harder in rural or remote areas (Truter, Russell & Fary, 2014; Jesus, Landry, Dussault & Fronteira, 2017), time and cost (Galiano-Gastillo et al., 2016) . In particular, costs related to home rehabilitation could be lower or at least equal, depending on the distance between the patient's home and the healthcare facility, compared with conventional home-visit rehabilitation (Tousignant et al., 2015).

When talking about the improvement of physical function and pain, real time telerehabilitation has proven to be effective and comparable to traditional rehabilitative protocols (Cottrell et al., 2016; Jiang et al., 2016; Mani et al., 2016; Shukla, Nair & Thakker, 2016; Cottrell & Russell, 2020).

What has emerged is that in order to be effective, home care telerehabilitation programs need the engagement and the commitment of the patient. To assure adherence to home-based programmes, patients should be motivated to improve their performance and favour a feeling

of being supported, considering that technologies are not substitutes for the human relationship between patients and care providers (Palazzo et al., 2016). Thus, the reported high level of patient satisfaction (Tenforde et al., 2020) could be crucial to assuring the effectiveness of telerehabilitation protocols. Despite a proven improvement in the quality of life (Amatya, Galea, Kesselring & Khan, 2015), the lack of evidence of the effectiveness of unusual telerehabilitation protocols, such as for multiple sclerosis or post orthopaedic surgery leave the door open for further investigation (Pastora-Bernal, Martín-Valero, Barón-López & Estebanez-Pérez, 2017).

Furthermore, the Covid-19 pandemic transformed the delivery of care due to the need to discharge as many patients as possible from hospital, whilst also representing an opportunity for increasing the adoption of telerehabilitation (Tenforde et al., 2020).

The second cluster in green contains 27 works. Telerehabilitation has been defined as *"the delivery of rehabilitation services via information and communication technologies"* (Brennan et al., 2010) enabling non-face-to-face interactions between the patient and the service provider. Examples of such technologies are computers, web cameras, an internet connection (Keck & Doarn, 2014), robotic devices, mainly used in the home setting (Sivan et al., 2014), which react to and interact with the environment and the patient (Muelling et al., 2017). These technologies are a combination of human intelligence and machine power that enhance the rehabilitative protocol, based on a twofold interaction between the wearer and the technology: *"physical human-robot interaction, and cognitive human-robot interaction"* (Gopura, Bandara, Kiguchi & Mann, 2016). Other technologies used for telerehabilitation are wearable sensors, used to enhance care for patients with neurologic and musculoskeletal conditions (Porciuncula et al., 2018). The Covid-19 pandemic presented new challenges for the healthcare system, which faced a necessary reduction of face-to-face interaction with patients, interrupting the access to routine medical care, and the opportunity to use remote communication technologies to support healthcare interventions (Mantovani et al., 2020). During the pandemic, some studies on the potential of such sensors have been carried out, dealing with patient monitoring, shifting service and care from hospital to the home and reducing the need for face-to-face contact (Ding et al., 2021).

It has the potential to substantially increase access to large-scale rehabilitation therapy (Wolf et al., 2015; Cramer et al., 2019), whilst also addressing the challenge of healthcare cost efficiency (Schwamm et al., 2017).

Patients' adherence is crucial to proving the effectiveness of tele rehabilitative protocols. To avoid a reduction in patient engagement due to the physical absence of the therapist (Chen et

al., 2019), the design of such technologies and protocols should be addressed in order to ensure maximum compliance (Dodakian et al., 2017).

The third cluster in dark blue contains 20 works. Digital health is usually associated to *"improved clinical decision-making and increased efficiency for healthcare providers",* but it could also represent an opportunity to expand access (Maddison et al., 2019; Bhaskar et al., 2020) to necessary prevention (Yan et al., 2016), not just treatments, and to increase patient attendance (Hwang et al., 2017) .

The key points to assess are the safety, effectiveness, adherence to and acceptance (Piotrowicz et al., 2015) of home-based telemedicine protocols. To do so, the strength of a telerehabilitation programme, compared to an in-person protocol, could be represented by a higher frequency of data transmission (Frederix et al., 2015) in order to determine the effectiveness of care. Caregivers play a decisive role in assessing patient behaviours, increasing motivation and self-efficacy (Piepoli et al., 2016).

What has emerged in the fourth cluster in yellow with 15 works, is that remote technologies enrich home-based environments, enabling patient learning and resilience (thus a process of adaptation to different stimuli) aimed at achieving improvements (Khan et al., 2017). To do so, caregivers play a decisive role in promoting telerehabilitation activities (Gandolfi et al., 2017).

The need to measure compliance (Charvet et al., 2017) comes together with the need to measure the benefits of the treatment (Horak, King & Mancini, 2015; Block et al., 2016). The reason behind the need to assess data and parameters related to telerehabilitation is due to a disconnection between self-reported and objective measures of improvement (Hornby et al., 2015). On the other hand, feedback, which is enabled by a combination of face-to-face and remote personal interactions, are necessary to understand the participant's motivation and self-management (Dobkin, 2016).

Barriers to optimal implementation could also be related to current healthcare systems (Yeroushalmi, Maloni, Costello & Wallin, 2019).

In the fifth cluster, in purple with 14 works, the main focus is on the application of telerehabilitation in chronic pulmonary diseases (Tabak et al., 2013; Ambrosino, Vitacca, Dreher et al., 2016; Bourne et al., 2017; Vitacca, Montini & Comini, 2018; Cox et al., 2018). For such chronic diseases, long-term adherence and satisfaction are supported by experienced benefits, self-efficacy and emotional safety (Haas et al., 2016).

The sixth cluster, in light blue with 13 works, is mainly related to telerehabilitation after a stroke (Chen et al., 2015; Chen et al., 2017; Sarfo, Ulasavets, Opare-Sem & Ovbiangele, 2018; Tchero, Tabue-Teguo, Lannuzel & Rusch, 2018) and virtual reality (Larson, Feigon, Gagliardo

& Dvorkin, 2014; Vaughan, Gabrys & Dubey, 2016), used in combination with conventional programmes (Lloréns, Noé, Colomer & Alcañiz, 2014). Telerehabilitation ensures the continuity of care from a hospital-based setting to the patient's home, empowering both the patient and the caregiver throughout the care process (Realdon et al., 2016).

### 4.4 Third stream: a review of technology acceptance theory in healthcare as the specific problem to address

It emerged from the second stream of analysis that there is an issue related to the acceptability of the technology.

Thus, there is the need to complete the literature review by carrying out an analysis on the technology acceptance model in healthcare. The research database is Scopus and the keywords are TAM and healthcare arises. The timelapse is the same as the previous levels in the literature review, as is the type of documents. The used query produced 1533 results[10], which are analysed using the VOSviewer according to the process already used for the first and second level analysis.

The author keyword co-occurrence analysis (Figure 4.7) is carried out using fractional counting and a thesaurus, with a threshold set at 10 and a minimum cluster size equal to 10.

[10] TITLE-ABS-KEY ( *technology AND acceptance AND model* ) AND TITLE-ABS-KEY ( *healthcare* ) OR TITLE-ABS-KEY ( *health AND care* ) OR TITLE-ABS-KEY ( *health-care* ) ) AND ( LIMIT-TO ( PUBYEAR , 2024 ) OR LIMIT-TO ( PUBYEAR , 2023 ) OR LIMIT-TO ( PUBYEAR , 2022 ) OR LIMIT-TO ( PUBYEAR , 2021 ) OR LIMIT-TO ( PUBYEAR , 2020 ) OR LIMIT-TO ( PUBYEAR , 2019 ) OR LIMIT-TO ( PUBYEAR , 2018 ) OR LIMIT-TO ( PUBYEAR , 2017 ) OR LIMIT-TO ( PUBYEAR , 2016 ) OR LIMIT-TO ( PUBYEAR , 2015 ) OR LIMIT-TO ( PUBYEAR , 2014 ) ) AND ( LIMIT-TO ( DOCTYPE , "ar" ) OR LIMIT-TO ( DOCTYPE , "cp" ) OR LIMIT-TO ( DOCTYPE , "re" ) OR LIMIT-TO ( DOCTYPE , "ch" ) OR LIMIT-TO ( DOCTYPE , "bk" ) )
10 Three documents have been removed from the database as they are not compatible with the software.

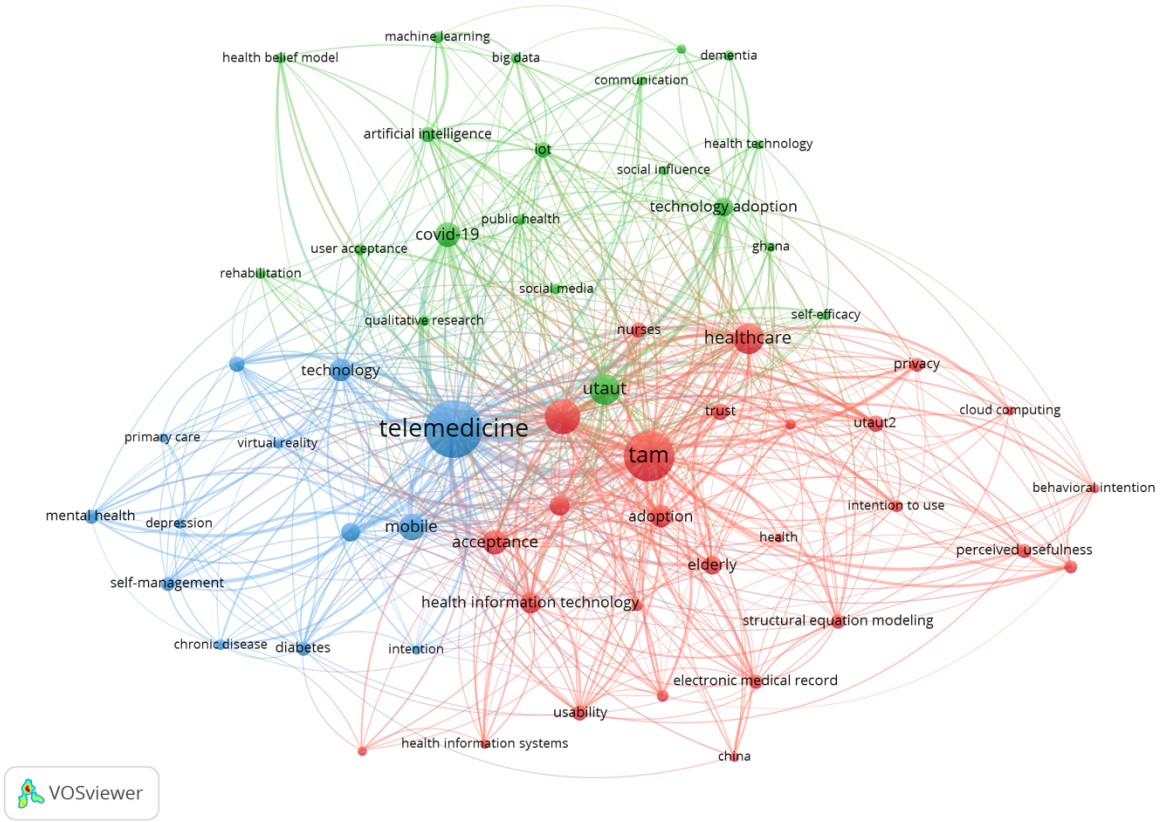


*Figure 4.7 - Vosviewer keyword co-occurrence map of TAM for the healthcare query - network visualisation*

- The first cluster, in red with 28 items, shows the keywords: acceptance, adoption, behavioural intention, cloud computing, elderly, electronic health record, electronic medical record, health, health information system and technology, healthcare, healthcare professionals, intention to use, nurses, perceived ease of use and usefulness, personal health record, physicians, privacy, structural equation model, TAM, technology acceptance, trust, usability and UTAUT2.
- The second cluster, in green with 20 items, shows the keywords: artificial intelligence, big data, communication, Covid-19, dementia, health belief model, health technology, IoT, machine learning, public health, qualitative research, quality of life, rehabilitation, self-efficacy, social influence, social media, technology adoption, user acceptance, UTAUT. The analysis of the intention to use telehealth through the UTAUT model, assessing self-efficacy, anxiety and attitude, allows us to predict the behavioural intention related to the technology (Kohnke, Cole & Bush, 2014).

- The third cluster, in blue with 13 items, is mainly composed of: chronic disease, depression, diabetes, implementation science, intention, mental health, mobile, primary care, self-management, smartphone, technology, telemedicine and virtual reality. TAM analysis is necessary to understand factors that can block or enable the implementation of telecare protocols which have been proven effective for chronic illnesses (Kamal, Shafid & Kakria, 2020).

Continuing with the reference co-citation analysis, with a threshold set at 15 and a minimum cluster size equal to 10, two clusters were produced (Figure 4.8):

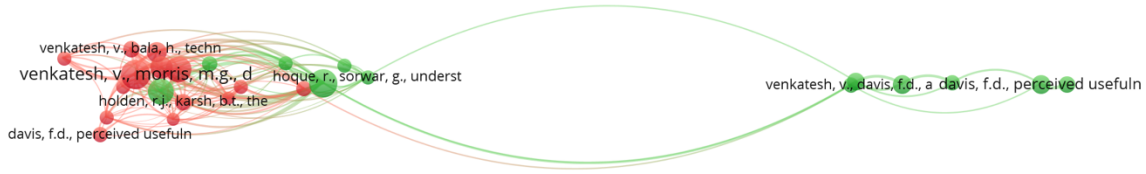


*Figure 4.8 – Vosviewer reference co-citation map of TAM for the healthcare query - network visualisation*

The main pillars of the most cited literature contained in the first cluster (in red with 13 works) are:

- The technology acceptance model and its evolution are used to understand the acceptance (Holder & Karsh, 2010) and usage of information technology (Taylor & Todd, 1995) ;
- Potential adopters could resist the usage of new technologies (Bhattacherjee & Hikmet, 2007). This resistance could influence the healthcare information technology usage decision (ibidem);
- The literature gives TAM key constructs: perceived usefulness, perceived ease of use, social influence/subjective norms, perceived behavioral control/facilitating conditions (Holder & Karsh, 2010);
- Theories related to TAM are:
  - Technology Acceptance Model 2 (TAM2), *"that explains perceived usefulness and usage intentions in terms of social influence and cognitive instrumental processes"* (Venkatesh & Davis, 2000),
  - Unified Theory of Acceptance and Use of Technology (UTAUT), formulated as a unified model and based on four key constructs: performance expectancy, effort

expectancy, social influence and enabling conditions (Venkatesh, Morris, Davis & Davis, 2003),

- Theory of Planned Behaviour (TPB) (Azjen & Fishbein, 1980), according to which *"human behaviour is guided by three types of considerations: beliefs about the likely consequences and experiences associated with the behaviour (behavioural beliefs), beliefs about the normative expectations and behaviours of significant others (normative beliefs), and beliefs about the presence of factors that may facilitate or impede performance of the behaviour (control beliefs)"* (Azjen, 2002) (Holder & Karsh, 2010).

The second cluster, in green with 10 works, highlighted that:

- TAM could be used to inform healthcare management about the existing barriers that make healthcare practitioners *"hesitant to embrace new technologies designed to increase efficiency and improve quality in the healthcare setting"* (Yarbrough, 2007);
- By assessing the propensity of patients to use new technologies through TAM, it is possible to proactively design interventions targeted at maximising its adoption (Venkatesh, Morris, Davis & Davis, 2003);
- A main issue while promoting the usage of a new technology is how managers or decision makers *"make informed decisions that can lead to greater acceptance and effective utilisation"* (Venkatesh & Bala, 2008).

Furthermore, the documents' bibliographic coupling analysis is carried out through VOSviewer on the same database of papers and by using fractional counting. By setting the threshold to 50 and a minimum cluster size of 15, the map shows 4 clusters (Figure 4.9):

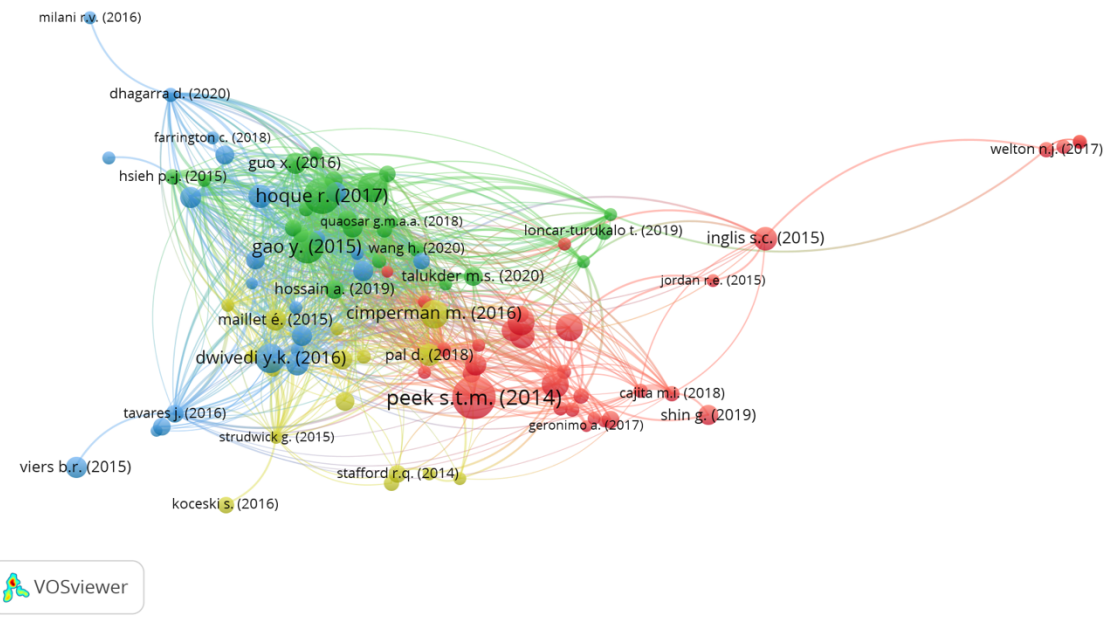


*Figure 4.9 – Vosviewer bibliographic coupling of documents map of TAM for the healthcare query – network visualisation*

The first cluster in red is made up of 32 works. With the lengthening of average life expectancy, patients face more chronic diseases (Anderson, Burford & Emmerton, 2016). At the same time, the number of new health technologies (Anderson, Burford & Emmerton, 2016; Arcury, et al., 2018) is increasing and the issues related to technology use and adoption emerge, for which TAM provides a useful lens for the analysis (Fejit, de Kort, Bongers & Jsselsteijn, 2018).

The factors that influence the adoption of new technologies could be explained by behavioural intention: perceived usefulness, perceived ease of use (Hoogenbosch et al., 2018), initial trust, consumer innovativeness, compatibility, health interest (Asadi, Abdullah, Safaei & Shah, 2019). Other factors could be performance expectancy, social influence (Zhang et al., 2019) and self-efficacy (de Veer et al., 2015; Golant, 2017).

The two arising themes are therefore: the decision to use (not use) the technology, and the engagement and use of it (Cook et al., 2016). The literature shows that initial trust has proven to be the most influential factor for adoption (Asadi, Abdullah, Safaei & Shah, 2019). Regarding older people, their propensity to adopting new technology is also due to unmet needs with traditional protocols, thus previous experiences (Golant, 2017) and is embedded in their personal, social, and physical context (Peek et al., 2016).

Social influence, perceived ease of use and perceived usefulness were significantly associated with an intention to use despite *"potential confounders (age, gender, race, education, income, and smartphone use)"* (Cajita, Hodgson, Budhathoki & Han, 2017).

Potential *"barriers included a lack of knowledge regarding how to use mHealth, lower sensory perception, a lack of need for technology, a poorly designed interface, the cost of the technology, and a limited/fixed income"* (Cajita, Hodgson, Lam, Yoo & Han, 2018).

Furthermore, being dependent on a caregiver could be another barrier. Previous studies show that caregivers and healthcare practitioners expressed more concern than patients about the shortening of in-person care generated by telecare (Geronimo et al., 2017). Health professionals' acceptance and adoption is indeed reported to be low for telehealth and moderate for online aftercare, despite literacy being elevated (Hannemann, Beutel & Zwerenz, 2017).

Regardless of these confounders and barriers, there is a widespread interest in the use of digital health for chronic diseases (Edwards et al., 2014).

To overcome such barriers, a user-centred approach to design and delivery (Greenhalgh et al., 2015) and an individually tailored approach (op den Akker, Jones & Hermens, 2014) built upon collaboration between patients, healthcare providers and caregivers (Cook et al., 2016) are necessary to improve user experience and effectiveness.

Educational interventions aimed at eHealth literacy could be helpful to enable the successful use of new technologies (Arcury et al., 2018).

The second cluster analysis, in green with 24 works, highlights a focus on the acceptance of wearable technologies (Gao, Li & Luo, 2015; Zhang, Luo, Nie & Zhang, 2017; Loncar-Turukalo, et al., 2019; Tsai et al., 2020). Determinants for adopting wearables are social influence, facilitating conditions (Quaosar, Hoque & Bao, 2018) and task-technology fit (Wang, Tao, Yu,& Qu, 2020).

One of the factors that affect the acceptance and use of telehealth technology is privacy (Gao, Li, & Luo, 2015), which is much more relevant for younger people and not as influential for older potential users (Guo, Zhang & Sun, 2016). Another factor to take into account is that any innovation is spread according to the law of innovation diffusion, and this is also true when applied to healthcare (Karahoca, Karahoca & Aksöz, 2017).

What has emerged from works not related to wearables technology is that technology anxiety (Talukder et al., 2020) and resistance to change significantly influence the elderly's behavioural intention to use telecare (Hoque & Sorwar, 2017). To overcome these blocks, the careful management of the doctor-patient relationship and activities aimed at raising patient awareness (Dou et al., 2017) could be helpful in supporting the adoption of telemedicine

technologies, particularly for chronic illnesses. Indeed, telehealth systems and physical medical services are mutually reinforcing rather than alternative (Zhou et al., 2019).

Talking about instruments used by healthcare professionals, such as the electronic health record (Hossain, Quaresma & Rahman, 2019), health clouds (Hsieh, 2015), data analytics (Shahbaz et al., 2019), it is possible to say that *"attitude, subjective norm and perceived behaviour control are shown to have positive and direct effects on healthcare professionals' intention to use"* (Hsieh, 2015) and that policymakers should increase the adoption of such technologies by promoting social strategies and training to achieve technical adequacy (Hossain, Quaresma & Rahman, 2019). Furthermore, when the level of confidence is higher than the perceived risk, the practitioner will trust the technology, thus initial trust could act as a key determinant in using new technologies (Fan, Liu, Zhu & Pardalos, 2020).

The forth cluster, in blue with 23 works, contains some works related to home-based (Milani, Bober & Lavie, 2016) telecare activities and devices, such as home healthcare robots (Alaiad & Zhou, 2014), virtual reality (Syed-Adbul et al., 2019), video visits (Viers et al., 2015), that can reduce errors and increase the safety and quality of the treatment (Alaiad & Zhou, 2014), alleviating the burden caused by healthcare and assistance needs (Li, Ma, Chan & Man, 2019).

Dealing, again, with the electronic health record (Kowitlawakul, Wai, Pulcini & Wang, 2015; Tavares & Oliveira, 2016), new relevant information has arisen from this cluster: the assessment of technology acceptance in this regard should also take into account organisational and contextual factors (Gagnon et al., 2014) .

The analysis of the technology acceptance of new healthcare technology should be used to inform healthcare policy makers (Dwivedi et al., 2016; Zayyad & Toycan, 2018) so as to promote the sustainable adoption of telecare. To maximise acceptance, service providers should express their willingness to refer and respect patients' feelings, opinions, and their own knowledge (Tsai C., 2014).

In this cluster, the key role of the risk-trust relationship (Dhagarra, Goswami & Kumar, 2020; Arfi, Nasr, Kondrateva & Hikkerova, 2021) while adopting a new healthcare technology is highlighted, both on the patient and on the provider sides.

In the last cluster, in yellow with 16 works, presents a first work related to organisational contextual factors that influence technology acceptance (Abdekhoda, Ahmadi, Gohari & Noruzi, 2015), describing management support as decisive for new technology adoption.

Furthermore, to implement telemedicine instruments, the barriers encountered by decision makers are: the availability of sustainable financial support to implement, operate and maintain the technology, the availability of basic facilities and ICT infrastructure in remote/rural areas

(Koceski & Koceska, 2016), and ensuring conformity (Alaboudi et al., 2016) and sustainability (Khosla, Nguyen & Chu, 2017). The acceptance of new technologies in healthcare is also due to socio-organisational factors which are specific to the healthcare context (Ammenwerth, 2019).

New digital technology applied to healthcare could represent an opportunity for hospitals, which should consider investments in new technology to increase their competitive advantage (Enaizan et al., 2020). To promote telemedicine and telehealth services, marketing strategies should be targeted at practitioners, using them as *"social agents to frame the service as useful and beneficial"* (Comperman, Brenčič & Trkam, 2016).

## 4.5 Main theoretical findings: the need to investigate the technology acceptance problem in the imposed innovation of future community and home care in Italy

The literature review related to teleassistance highlights the opportunities arising from the use of these technologies. Further to this, what is relevant are the possible issues. In the light of the VSA, while the structure of teleassistance could be seen as defined, thanks to available technologies and the structures that promote their use, such as hospitals (Li, Yang & Burdet, 2016), the core issue is the systems of operand and operant resources that interact together to use such technologies.

To activate the care process, the user (the patient or the caregiver) should be able to use the technology and should present a willingness to use it. Thus, in a service dominant logic perspective, patients and their caregivers are the activators of the value co-creation process. On the other hand, the willingness, thus the acceptance of new teleassistance technology, is crucial to activating the process, both from the patient/caregiver side and the healthcare practitioners' side.

Dealing with the telerehabilitation literature review, it is possible to say that the growing demand for specialized services and due to the limited healthcare resources, telerehabilitation could promote access to high-quality care, offering flexible, low-overhead proactive opportunities for clinicians (Howard & Kaufman, 2018).

Current limitations unearthed by the literature consist of: a high variability in clinical conditions, the patient population, methodological approaches, technology and the quality of evidence coming from available studies (Howard & Kaufman, 2018). Furthermore, the absence of a formal structure for the delivery of telerehabilitation and the exchange of data (DeFre

Galea, 2019) could represent another limitation to the implementation of large-scale telerehabilitation protocols.

What emerges from the TAM literature review is that the most used models in healthcare are the standard Technology Acceptance Model (TAM) (Davis, 1989), the TAM2 (Venkatesh & Davis, 2000), the Theory of Planned Behaviour (TPB), and the Unified Theory of Acceptance and use of Technology (UTAUT) (Venkatesh, 2003). Furthermore, the implementation of new remote technology is a paradigm shift from once physician-centred environment to a more patient-centric healthcare system (Edgren, 2006). In this patient-centric system, caregivers and healthcare practitioners are more reluctant to embrace innovation than patients, representing a barrier to implementation. Policymakers should consider all the factors that affect technology acceptance to design a strategy aimed at effective adoption, such as healthcare practitioner training and investments in technologies.

It is possible to outline constructs of TAM and their items, that will represent the starting point to develop a synthesis model further used in the explorative empirical investigation:

| **Variables** | **Items** |
|---|---|
| Perceived usefulness | Perception that using system leads to enhanced personal performance (original TAM definition) (Van Schaik, Bettany-Saltikov & Warren, 2002; Barker, Schaik & Corbett, 2003; Liang, Xue & Byrd, 2003; Mun, Jackson, Park & Probst, 2006; Han, Mustonen, Seppänen & Kallio, 2005; Paré, Sicotte & Jacques, 2006; Wu, Wang & Lin, 2007; Liu & Ma, 2006; Tung, Chang & Chou, 2008)<br>Perception that using system will help user attain gains in job performance (UTAUT definition) (Chen, Wu & Grandall, 2007; Schaper & Pervan, 2007; Duyck et al., 2008) |
| Perceived ease of use | Perception that using system will be free from physical or mental effort (original TAM definition) (Van Schaik, Bettany-Saltikov & Warren, 2002; Liang, Xue & Byrd, 2003; Barker, Schaik & Corbett, 2003; Han, Mustonen, Seppänen & Kallio, 2005; Mun, Jackson, Park & Probst, 2006; Paré, Sicotte & Jacques, 2006; Liu & Ma, 2006; Tung, Chang & Chou, 2008) |
| Social influence/subjective norm | Perception of important (or relevant) others' beliefs about person's use of system (TAM2, UTAUT, and TPB definition) (Chau & Hu, 2002; Chismar & Wiley-Patton, 2002; Mun, Jackson, Park & Probst, 2006; Chen, Wu & Grandall, 2007; Schaper & Pervan, 2007; Duyck et al., 2008) |
| Perceived behavioral control/facilitating conditions | Perception that organizational and technical infrastructure exists to support using system (UTAUT definition) (Chen, Wu & Grandall, 2007; Schaper & Pervan, 2007; Duyck et al., 2008) |

| | |
|---|---|
| | Perception of internal and external resource constraints on performing behavior (adaptation of TPB definition) (Mun, Jackson, Park & Probst, 2006)<br>Perception of availability of skills, resources, and opportunities necessary for using the technology (adaptation of TPB definition) (Chau & Hu, 2002) |

*Tab 4.10 – TAM variables and items. Author's elaboration*

What emerges from the literature review is that the transition towards community and homecare models should take place through (digital) technology innovation. Thus, the main problem to address becomes the acceptance of these technologies by patients and caregivers and by the service providers network (doctors, nurses, and other healthcare practitioners). Furthermore, a prerequisite is a policy makers' governance strategy that is aimed at creating the conditions for introducing the new technologies, as it seems to appear from the PNRR.

## 4.6 A model to investigate the technology acceptance problem in the implementation of telerehabilitation

The most relevant and used technology acceptance models for healthcare are highlighted in the literature review. Thus, these models are integrated to derive a synthesis model able to guide the explorative empirical investigation.

The third level of the literature review highlighted the main constructs related to the technology acceptance model:

- TAM, a psycho-social model, according to which the acceptance of the technology depends on the positive or negative attitude of potential users towards the technology itself. In this model, the acceptance of the technology is influenced by:
    - Perceived usefulness (Davis, 1989);
    - Perceived ease of use (Davis, 1989);
- TAM2 (Venkatesh & Davis, 2000), an extension of TAM, is aimed at overcoming the limitations of the previous model, focused only on individual belief, widening the range of factors to social influence. Its constructs are:
    - Subjective norms;
    - Image;
    - Job relevance;
    - Output quality;
    - Result demostrability;

In this model, experience and voluntariness are mediating variables between the subjective norm, the perceived usefulness and the behavioural intentions.

- PTB (Theory of Planned Behavior), a model that describes human behaviour as a consequence of intentions, on the one hand, and of human psychology on the other. Intentions are affected by the following factors:
    - Attitude;
    - Subjective norms;
    - Perceived behavioural control;
- UTAUT (Unified Theory of Acceptance and use of Technology), is the theory developed by Venkatesh in 2003 to unify the view of technology acceptance. Its constructs are:
    - Performance expectancy;
    - Effort expectancy;
    - Social influence;
    - Facilitating conditions.

Given these models and their constructs, we derived a synthesis model to assess the technology acceptance model within the context of the experimental implementation of new digital technologies at the Nuova CTA. It is made up of the following constructs and items:

| | |
|---|---|
| Perceived usefulness | Useful for job (or task) (Hu, Chau, Sheng & Tam, 1999; Liang, Xue & Byrd, 2003; Han, Mustonen, Seppänen & Kallio, 2005; Wu, Wang & Lin, 2007)<br>Increases productivity (Hu, Chau, Sheng & Tam, 1999; Chismar & Wiley-Patton, 2002; Barker, Schaik & Corbett, 2003)<br>Enhances effectiveness of job (or work) (Hu, Chau, Sheng & Tam, 1999; Chismar & Wiley-Patton, 2002; Barker, Schaik & Corbett, 2003)<br>Allows tasks to be accomplished more quickly (Liang, Xue & Byrd, 2003; Liu & Ma, 2006; Abdekhoda, Ahmadi, Gohari & Noruzi, 2015)<br>Improves job performance (Mun, Jackson, Park & Probst, 2006)<br>Make it easier to do job/work (Liang, Xue & Byrd, 2003)<br>Increases quality of care (Chismar & Wiley-Patton, 2002)<br>Increases quality of work (Liang, Xue & Byrd, 2003)<br>Improves work efficiency (Tung, Chang & Chou, 2008)<br>Allows tasks to be done more accurately (Van Schaik, Bettany-Saltikov & Warren, 2002)<br>Allows tasks to be done more objectively (Van Schaik, Bettany-Saltikov & Warren, 2002) |

| | |
|---|---|
| | Supports critical aspects of job (Barker, Schaik & Corbett, 2003)<br>Increases chance of getting a raise (Duyck et al., 2008)<br>Allows greater control over work (Liang, Xue & Byrd, 2003)<br>Enables decisions based on better evidence (Van Schaik, Bettany-Saltikov & Warren, 2002)<br>Improves patient care and management (Hu, Chau, Sheng & Tam, 1999) |
| Perceived ease of use | Easy to use (Hu, Chau, Sheng & Tam, 1999; Mun, Jackson, Park & Probst, 2006; Duyck et al., 2008)<br>Clear and understandable (Hu, Chau, Sheng & Tam, 1999; Mun, Jackson, Park & Probst, 2006; Duyck et al., 2008)<br>Easy to become skillful with system (Hu, Chau, Sheng & Tam, 1999)<br>Easy to get it to do what you want it to (Hu, Chau, Sheng & Tam, 1999)<br>Easy to learn to operate (Hu, Chau, Sheng & Tam, 1999)<br>Flexible to use/interact with (Hu, Chau, Sheng & Tam, 1999)<br>Low mental effort (Barker, Schaik & Corbett, 2003)<br>Easy to do what I want (Tung, Chang & Chou, 2008)<br>Easy to do tasks with system (Barker, Schaik & Corbett, 2003)<br>Clear (Liang, Xue & Byrd, 2003)<br>Understandable (Liang, Xue & Byrd, 2003)<br>Does not demand much care and attention (Tung, Chang & Chou, 2008)<br>Navigation is easy (Liu & Ma, 2006)<br>Easy to remember how to perform tasks with system (Mun, Jackson, Park & Probst, 2006) |
| Social influence/subjective norms | People who influence my behaviour think I should use the system (Duyck et al., 2008)<br>People who influence my clinical behaviour think I should use the system (Chau & Hu, 2002)<br>People who are important to me think I should use the system (Duyck et al., 2008)<br>People whose opinion I value think I should use the system<br>People who are important to my health care services think I should use the system (Chau & Hu, 2002)<br>People who are important in assessing my patient care and management think I should use the system (Chau & Hu, 2002)<br>Senior management of the hospital/structure has been helpful (Duyck et al., 2008)<br>Hospital/structure supported use of system (Duyck et al., 2008)<br>Colleagues who are important to me think I should use the system (Mun, Jackson, Park & Probst, 2006)<br>Superior at work think I should use the system (Mun, Jackson, Park & Probst, 2006)<br>Subordinated at work whink I should use the system (Mun, Jackson, Park & Probst, 2006) |

| | |
|---|---|
| Perceived behavioural control/facilitating conditions | Have necessary resources to use the system (Chau & Hu, 2002)<br>Have knowledge to use the system (Chau & Hu, 2002)<br>Compatibility with other systems (Duyck et al., 2008)<br>Availability of technical assistance (Duyck et al., 2008)<br>Able to use system at work (Mun, Jackson, Park & Probst, 2006)<br>Able to use system for patient care and management (Chau & Hu, 2002)<br>Using system at work is wise (Mun, Jackson, Park & Probst, 2006)<br>Using system is entirely under my control (Chau & Hu, 2002) |
| Behavioral intention to use | Given the chance, I intend to use the device for telerehabilitation (Gao, Li & Luo, 2015)<br>I am willing to use the technology for telerehabilitation in the near future (Gao, Li & Luo, 2015)<br>I will frequently use the technology for telerehabilitation (Gao, Li & Luo, 2015)<br>I will recommend the technology for telerehabilitation to others (Gao, Li & Luo, 2015) |

*Tab 4.11 – TAM variables and items for the questionnaire*

The model designed to carry out the investigation at the Nuova CTA could be summarised as follows (Figure 4.12, Figure 4.13, Figure 4.14):

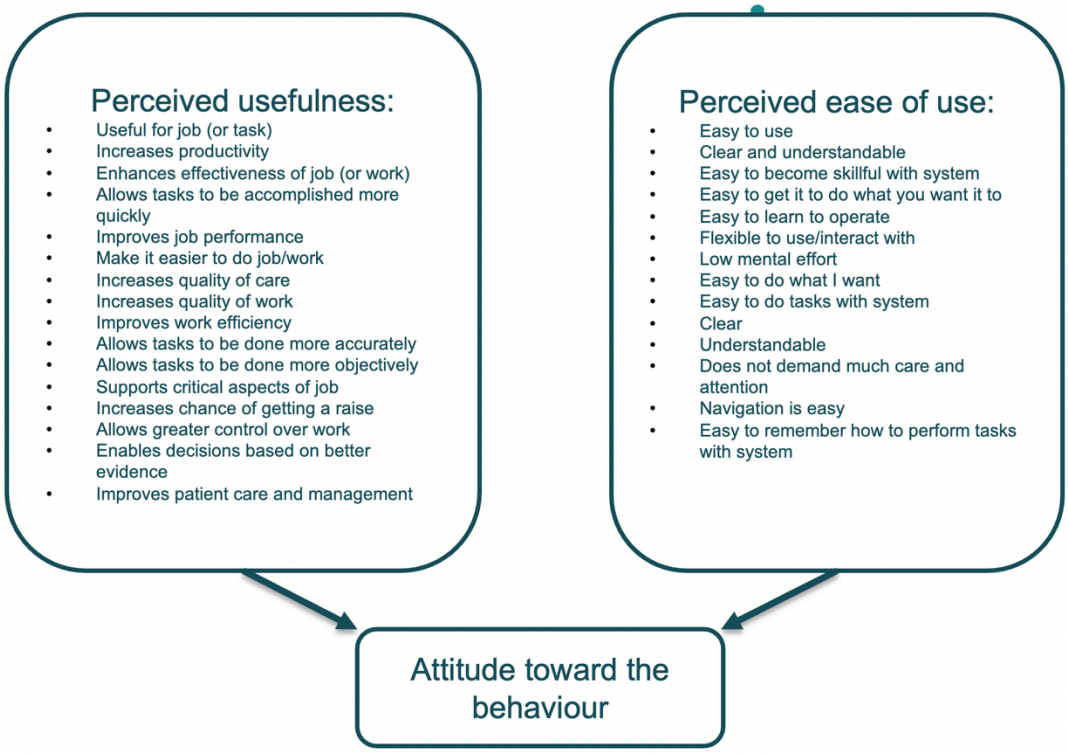


*Figure 4.12 – Author's elaboration*

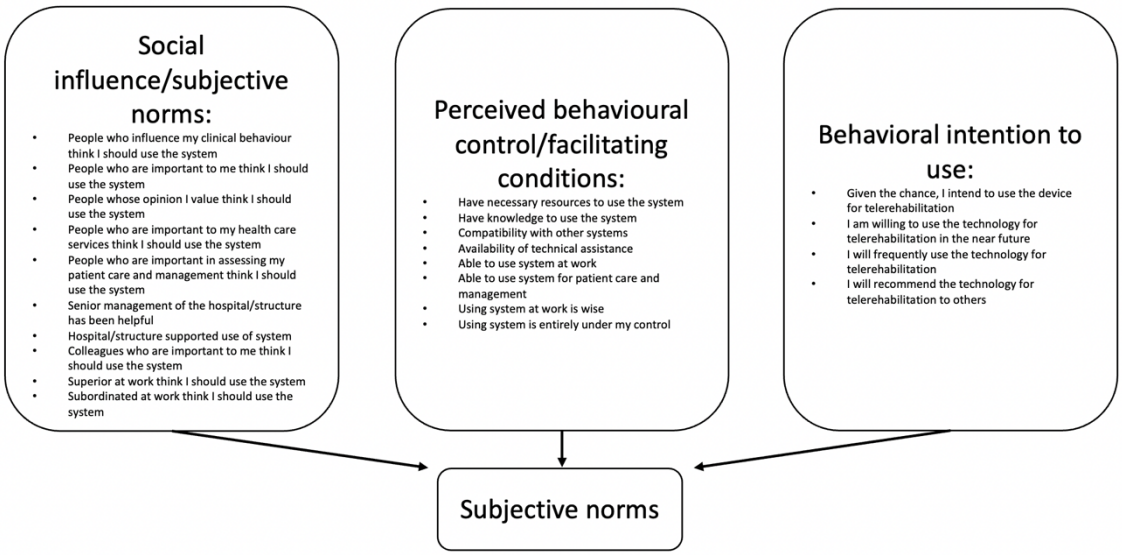


*Figure 4.13 – Author's elaboration*

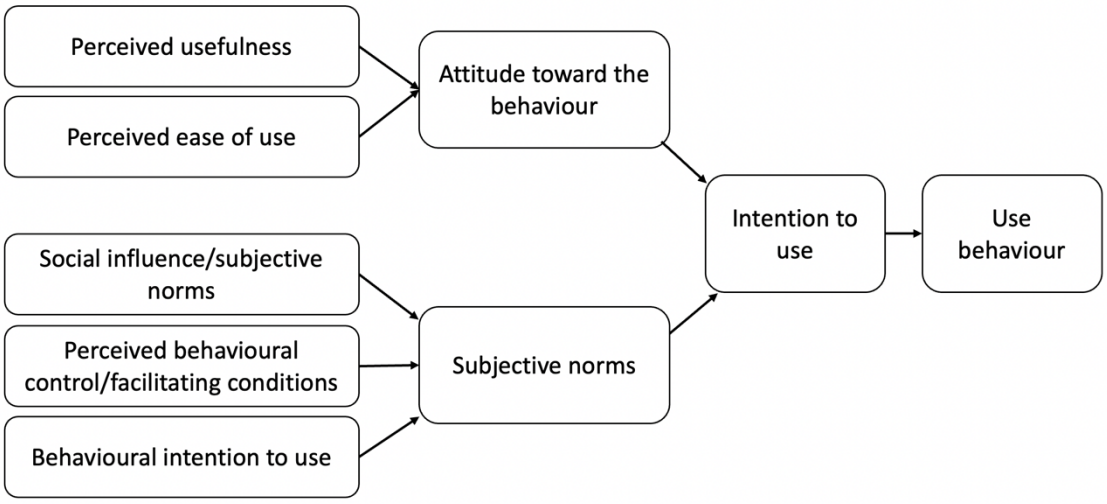


*Figure 4.14 – Author's elaboration – technology acceptance synthesis model*

As we can see, the attitude towards the behaviour is affected by both the perceived usefulness and the perceived ease of use, while the subjective norms are affected by the social influence/subjective norms, the perceived behavioural control/facilitating conditions, and the behavioural intention to use.

The attitude toward the behaviour and the subjective norms should influence the intention to use and, thus, the usage behaviour. This model will guide the further step of the analysis,

resulting in a base questionnaire[11] through which it will be possible to run the in-depth interviews, the goal of which is to assess the acceptance of the technology by the healthcare professional.

[11] Available in Appendix II in Italian.

# CHAPTER V – A CASE STUDY-BASED EMPIRICAL EXPLORATION OF THE MAIN CONCEPTUAL AND THEORETICAL FINDINGS (STEP 3)

The future of healthcare is evolving towards community care. Teleassistance is one of the possible research lines which needs to be deeply analysed, whether it is provided by affiliated healthcare facilities, by local healthcare authorities or by pharmacies.

The view is not the traditional dichotomy between the hospital and the territory, but rather an integration between different healthcare providers across the national territory to ensure the accessibility to equal care. To do so, and to diminish distances between patients and healthcare providers, technology is the enabling factor.

Healthcare is service-based by definition and the necessary service innovations for the future are technological, as stated in the ambitions of the PNRR. These innovations will affect healthcare both on a systemic and structural level.

The state of the art of the community healthcare does not show the conditions of an effective implementation of new technologies for future community and proximity healthcare. A relevant consideration, indeed, in the light of the PNRR areas of action, is that the programmed investments are all aimed at structurally strengthening rather than systemically. The activities programmed and the areas of action are aimed at renovating the current facilities (i.e. new equipment), and creating new ones (i.e. Community hospitals and houses in the community). The PNRR does not include financing actions for human resources, such as training and education.

In this landscape, technologies can provide relevant opportunities to develop empowering environment for patients (Ciasullo, Orciuoli, Douglas & Palumbo, 2022) and efficient ecosystems with an effective service offering. A potential effective ecosystem should be based on human resources (systemic), which are the actors that could enable innovations and the evolution of the ecosystem itself, and on the exchange of data and information addressed to involve patients in the healthcare value co-creation and in the service co-production processes (Ciasullo, Lim, Manesh & Palumbo, 2022). Trying to analyse the issue both at a macro- and micro- levels, the main drivers for managing the emergence of value co-creation and innovation are co-design, co-development, co-delivery, co-learning (Barile, Grimaldi, Loia & Sirianni,

2020). Thus, human resources could represent a decisive factor when it comes to innovating the healthcare service ecosystem.

The investigation on the role of technology in the implementation of telerehabilitation and its critical factors, due to the need for service innovation, is decisive. Indeed, an effective interaction between humans and technologies, over time, is expected to amplify human capabilities and to make them complementary (Barile et al., 2021).

Technology, in this context, could be helpful for the new community healthcare, and telerehabilitation could be a solid opportunity to assuring accessibility to and continuity of care for the elderly and chronic patients.

Thus, the question is: what are the necessary conditions for implementing telerehabilitation in an effective, efficient, sustainable, and safe way?

An example to explore is telerehabilitation, which is a practical case of the transition from hospital-based provision to community and homecare.

Given our theoretical findings, the head node related to the implementation of technology innovation enabling community and homecare is the acceptance of the technology itself, we are able to proceed with the empirical exploration.

As a premise of this phase of the research, it should be considered that, at first, the investigation should have been conducted on the experimental implementation of tele rehabilitative protocols. Thus, we sought out an affiliated healthcare facility which is about to start the experimentation of new technologies for telerehabilitation in the Campania region. The selected facility is Nuova CTA, which is using Khymeia technologies. The empirical exploration started in line with the Nuova CTA's experimental implementation of virtual rehabilitation, rehabilitation through the use of advanced technologies and telerehabilitation. During the study, the authorisation for telerehabilitation, which should be given by the Healthcare Local Authority of Salerno (ASL di Salerno), didn't arrive. Thus, we had the opportunity to investigate the impact of the introduction of the main technology in the provision of the rehabilitation service, with it being an opportunity for our study to investigate if and how this phase could represent an enabling factor for the introduction of digital technology to shift from traditional protocols towards telerehabilitation.

The empirical exploration aims to understand which is a possible path to pursue a shift in the medical practice towards remote assistance and rehabilitation through digital technologies. Considering the current and potential teleassistance and telerehabilitation models, we analyse the Nuova CTA case to understand the acceptance of technology and to derive an effective

path for new technology implementation for community and home care services, and the potential blocks and enabling factors.

More specifically, the case study will provide us with empirical evidence that supports our hypothesis.

## 5.1 The case-study methodology to empirically investigate the Nuova CTA experience

The approach used for the investigation is a qualitative empirical analysis based on a case study (Crowe et al., 2011). Being the empirical investigation run only on a single case and being the objective merely explorative, the model derived in 4.6 to investigate the technology acceptance problem served as a guideline for carrying out the in-depth interviews. This happened because the test of the questionnaire did not give positive results in terms of the understanding, expressed by the involved actors, of all the nuances of the various problems considered.

The research team, during the test of the questionnaire, addressed to the administration to the different actors involved in the implementation of the technologies, has encountered a series of interpretative critical issues with the staff. These issues could compromise both the willingness to answer to all the questions related to different aspects, and the understanding of the different shades of meaning, also.

The research is carried out by a multi-disciplinary team of the Pharmanomics, the interdepartmental research centre for pharmaceutical and pharmacoeconomic technologies.

*"The mission of the Centre (lasting ten years) is to create interdisciplinary research opportunities, provide advice and guidance and disseminate new information and knowledge in the health sector. The Centre's activities focus mainly on Pharmaceutical Technologies, Socio-economic and Pharmaceutical Legislation, Pharmacology, Toxicology, Pharmacoeconomics and Pharmacovigilance"* (Pharmanomics).

The context in which Pharmanomics' activities take place is characterised by effective multidisciplinary co-creation, defining a field of knowledge capable of integrating all the different possible perspectives necessary to study a complex ecosystem such as healthcare. This multidisciplinary feature somehow reflects the perspectives used by institutions, public and private organisations, healthcare providers, patients/citizens, and all the other actors involved in the care process. The interdepartmental centre (Department of Pharmacy, Department of Medicine and Surgery, Department DISA-MIS), due to its very nature,

encourages the promotion of scientific debate at local level and its extension at a national and international level, in line with national and EU guidelines, with a primary focus on health issues, such as:

- coordinating and promoting research, studies and debates on the main themes of Pharmacovigilance and Pharmacoeconomics, at national and international level;
- developing and managing new pharmaceutical technologies;
- planning, evaluating and monitoring interdisciplinary health projects;
- providing support for organisational and economic decision-making in emerging sectors, such as the introduction of new technologies, the replacement of obsolete technologies, changes in the paths of care and activation of research and training processes;
- providing research, consultancy, information and training services for research entities, universities and enterprises in the field of the development and application of new pharmaceutical technologies;
- improving the knowledge of all health professionals (pharmacists, doctors, biologists, health graduates, economists, legal experts) institutionally responsible for identifying adverse reactions, side effects, drug interactions, as well as herbal, cosmetic and nutraceutical products;
- promoting and sharing in-depth knowledge of the risk/benefit relationships in the use of medicines and health products (herbal products, cosmetics, nutraceuticals, medical devices);
- joining or promoting national and international networks.

### 5.1.1 The context

The case study based empirical exploration takes place as part of a research line conducted by the Pharmanomics Research Centre at the University of Salerno aimed at *"Studying the structural and systemic conditions to develop advanced telerehabilitation programs"*[12].

The research line starts with the contextual premises:

- The management of patients with severe or chronic conditions poses a managerial, economic and organizational problem which is no longer adequately addressed by the current structure of the Italian NHS;

[12] "Studio delle condizoni strutturali e sistemiche per lo sviluppo di sistemi avanzati di tele riabilitazione"

- The ageing population poses the additional challenge of more patients with one or more chronic illnesses, thus increasing the need for programs to prevent and manage cognitive and physical decay, with an impact also being had on caregivers and families. This is combined with increasing public expenditure.

These elements lead to the need for decentralized health services, consisting, on the one hand of the discharge of patients from hospital, through the shift of therapies to a community and home-based level. And, on the other hand, the need for new care models to transfer a huge part of the decisive expertise to the local area.

Some regions reacted to this changing scenario including telemedicine and telerehabilitation in the regional DRGs, therefore preparing the legislative framework to be ready for the implementation of new treatment programs. Furthermore, the Covid-19 pandemic has further complicated the scenario, making the management of therapeutic programs and patients more difficult. Thus, due to the complexity of healthcare, on the one side, and of the scenario on the other, new frontiers of research have emerged.

Given that rehabilitation is one of the most burdening long-term healthcare services in terms of social and economic impact, the focus is on the innovative (and digital) forms of care, such as telemedicine and, in particular, telerehabilitation. Originally conceived for remote/rural areas to ensure and improve accessibility to care, the model progressively spread thanks to the introduction of technology, particularly during the pandemic. Teleassistance and telerehabilitation provide the patient with high quality care, which would otherwise be unavailable, and to implement monitoring, follow-up, prevention, and maintenance programs that would equally be impossible to implement.

Among the areas of application of telerehabilitation we can found neuromotor, respiratory, and cognitive rehabilitation, the prevention of cognitive decay, the treatment of chronic pain, occupational therapy, the development and maintenance of social integration.

To empower this, the PNRR has a precise action focus on telemedicine and telerehabilitation, with the aim of strengthening intermediate health care and its facilities (Community hospitals or health homes) through the construction of proximity networks (facilities and telemedicine) for local health care and for transferring as many care services as possible to patients' homes.

In this research line, our research and investigation take place thanks to a multidisciplinary team at the Pharmanomics Research Centre.

### 5.1.2 The objective

In the light of the developed interpretative path, the analysis of the case study is addressed to explore the issue of technology acceptance, having the opportunity to be based on empirical experience, opinions, and actual perceptions.

### 5.1.3 Study design

The study follows three different phases.

The first phase of the study involves the organization and carrying on focus groups with the selected key stakeholders, with the aim to share exploration objectives, first impressions and relevant aspects of the process of implementation of Khymeia technologies in the Nuova CTA.

The second phase consists of the observation of the process of implementation of Khymeia technologies and the subsequent training activities.

The third and last phase consists of in-depth interviews carried out with the main stakeholder involved in the process under analysis.

## 5.2 The case: the implementation of Khymeia technologies in the Nuova CTA

Three actors are involved in the project:

- The Pharmanomics interdepartmental centre at the University of Salerno;
- The Nuova CTA affiliated healthcare facility;
- The technology provider Khymeia.

To investigate the structural and systemic conditions for the introduction of new technologies, Pharmanomics began the collaboration with a health facility operating locally, the Nuova CTA of Acerno (SA), and with a leading company in the technology sector, active in e-health innovation, the Khymeia Group.

The pilot project is aimed at testing the introduction of advanced tele-rehabilitation systems locally, highlighting opportunities and critical issues.

In the future, other actors will be involved in order to pursue this research on a wider level. There is an on-going interaction with the ASL of Salerno about a possible trial of telerehabilitation technologies and the possible related research.

### 5.2.1 The actors involved: the Nuova CTA professional network

Nuova CTA is a physiotherapy and rehabilitation centre, accredited by INHS, located in Acerno in the province of Salerno.

The Nuova CTA has three business units:

- Nuova CTA is in charge of outpatient and home rehabilitation that, since 1982, operates in *Monti Picentini*, up to Salerno and Sapri;
- Casa San Pio (Community to protect the non-sufficient and elderly), established in 2012. The residential activities are implemented with 24 beds for adults not self-sufficient and children between 11 and 18 years old. To date, almost all beds are occupied. This has allowed the development of collateral services such as tele-visits, telemedicine, telerehabilitation and to create a real synergy between rehabilitation and other therapies.
- Liberi di sognare (Multipurpose social centre for the disabled), whose very nature is the promotion of social welfare in the area plan with a maximum capacity of 30 in the programme.

Nuova CTA's mission is to contribute to the improvement of health care. The offer is made up of increasingly specialised and innovative rehabilitation services and a series of complementary services for more comprehensive user care.

As shown on their website, the basic principles of Nuova CTA are:

- Equality;
- Impartiality;
- Right of choice;
- Right to confidentiality;
- Participation;
- Effectiveness and Efficiency

The work of Nuova CTA is aimed at achieving economic sustainability. To do so, the organisation monitors and defines interventions related to effectiveness, efficiency, social effectiveness, quality and continuity of care.

The vision of Nuova CTA is to develop and improve the quality and range of the provided services. The core principle of Nuova CTA's offer is the humanisation of the care process, building a strong relationship of trust with all the actors involved, whether they are medical personnel, patients, families or caregivers. The company is involved in research projects and pursues a strategy aimed at the implementation of innovative procedures, methodologies, equipment and technologies, particularly related to rehabilitation. Thus, telerehabilitation is a huge opportunity for Nuova CTA to expand its service offer in order to ensure the accessibility to and the continuity of high standards of care.

The personnel involved in the experimental implementation of the technology was as follows:

### 5.2.2 The actors involved: the Khymeia technologies provider

The Khymeia Group, established in 1998, is a leading company in the research and development of new healthcare technologies, aimed at the realisation of unique and innovative technologies in the field of telerehabilitation with virtual reality technology.

The company devotes every resource to the development of its technologies, accompanied by a rigorous focus on clinical testing and validation to help patients exploit their residual abilities and recover the functions lost due to neurological, musculoskeletal or cardiorespiratory trauma.

Khymeia's systems are the result of a process of continuous innovation based on research, aimed at meeting clinical needs effectively and reliably.

The technologies are aimed at rehabilitation:

- neurological rehabilitation with reference to modules such as: neuromotor, motor, omnidirectional path, fall prevention, phonation, hand and wrist, EMG, immersive VR, augmented reality, minimal state of consciousness, postural, cervical, cognitive, logopaedic, facial spine;
- orthopaedic rehabilitation with reference to modules such as: motor, postural, cervical spine, EMG, fall prevention;
- cardiorespiratory rehabilitation with reference to the respiratory module.

One of the peculiarities of the company is that the designed telerehabilitation ecosystem is fully managed by the cloud portal Khymeia KLOUD Network, which allows for an effective management of technologies and the related processes, as well as knowledge sharing (Siano & Palazzo, 2021).

Dealing with the technologies specifically aimed at telerehabilitation, Khymeia developed the VRRS – Virtual reality Rehabilitation System – ecosystem. It is an innovative methodology internationally patented and initially developed together with the Boston MIT that aims to support the therapist in rehabilitation and telerehabilitation in relation to both neurological and skeletal diseases.

Operationally, the VRRS system acts as a central 'HUB' to which it is possible to connect a series of specialised devices, generating reports integrated in the same patient file. Therefore, with only one machine it is possible to provide different rehabilitation modules for evaluation and treatment.

The system is available in different versions and with various configurations suitable both for the use of the method at the clinical centre and at the patient's home.

The systems work in a network with each other, so the user can use multiple systems simultaneously both on site and remotely.

In terms of effectiveness, the method is currently adopted as a clinical routine in many of the best centres of rehabilitation excellence[13].

In terms of possible configurations, they are customisable according to specific needs, including the ability to manage multiple patients simultaneously; in fact, once the patient has been evaluated, the therapist can compile the patient's personalised exercise card with extreme simplicity and speed. The patient will also be assisted by the 'VRRS Smart Virtual Assistant' that will guide them interactively and in real time when doing the exercises.

Regarding the Telerehabilitation application, the VRRS system is completely remote-controlled by means of home devices, the VRRS Home Tablets that are remotely controlled in real time via a specific workstation, the TELECOCKPIT. This is the only system currently available for a real implementation of a home treatment that is equal to what is done in the facility.

### 5.2.3 The Khymeia technologies

Nuova CTA has gradually implemented the following Khymeia systems:

- VRRS EVO (Figure 5.1), conceived as a 'central hub' to which it is possible to connect a series of specialised peripheral devices via USB integrated into the system, with which it is able to provide up to 20 different rehabilitation modules.

VRRS Evo is used as a clinical routine for the rehabilitation of a wide range of pathologies through the numerous modules, including: motor, cognitive, speech, phonation, postural

[13] Such as:
- IRCCS Bonino Pulejo Messina (project coordinator)
- IRCCS Fatebenfratelli Brescia
- IRCCS San Raffaele Milano
- IRCCS Don Gnocchi (Milan and soon in Florence)
- IRCCS Mondino Pavia
- IRCCS Istituti Maugeri (Veruno, Milan, Genoa, Telese, Lumezzane, Bari, Mistretta, Pavia)
- IRCCS San Raffaele Pisana Roma
- IRCCS San Camillo Lido di Venezia
- IRCCS Oasi Maria S.S. Troina
- IRCCS Santa Lucia Roma
- IRCCS Humanitas Milano
- IRCCS Stella Maris Pisa
- IRCCS La Nostra Famiglia

dynamic and static treatments, facial, hand and wrist, cardiorespiratory, orthopaedic, EMG, tDCS, isoinertial, immersive VR, Augmented Reality and more. It is the largest dynamic library available and it is equipped with more than 800 clinical exercises in immersive scenarios, with an artificial intelligence and evaluation system which generates visual, sound and tactile feedback. All exercises include the compensation sensors, and all are equipped with a video preview with the integrated virtual assistant. The exercises are fully customisable to suit the needs of the specific patient and can be arranged into clinical protocols. The exercises are equipped with a scoring system, which can be modulated in relation to the patient's residual abilities, to further stimulate the execution of the activities. It is equipped with remote touch technology and a virtual assistant. It is extraordinarily simple to use, both via the screen and via the wireless controller. The system has a simplified, user-friendly interface, which allows all its features to be instantaneously managed. Each exercise is equipped with a preview clip showing the correct positioning of the sensors and the performance of the exercise. VRRS Evo is developed to be freely configured according to your specific clinical needs. Also, in terms of hardware, VRRS Evo can be configured in different solutions, including wall projection for maximum immersivity of the scenarios. The system does not require any structural modification for the implementation, nor any special electrical setups. Moreover, it is equipped with wheels for fast and extremely simple handling. The VRRS Evo sensors do not require any specific settings and no initial position reference, with this being automatically generated by the system, thus allowing you to activate the exercises in no time.

- The Hand Box (Figure 5.2), which it is able to reconstruct the kinematics of the hand in real time, without the need to wear any type of glove or sensor, making the user completely free of impediments to perform the rehabilitation activity thanks to a special camera system. The different activities for fine hand rehabilitation include:
    - wrist rehabilitation
    - rehabilitation of individual fingers
    - coordinated activation of the fingers
    - coordinated activation of grasp and pinch sockets.

  This accessory is a very advanced system that allows all the parameters of the hand to be detected, including the pressure points.
- The Oculus: a real virtual reality for children and adults that allows you to be part of an immersive 3D experience.

- The TeleCockpit (figure 5.3), an innovative technological workstation, equipped with an integrated video conferencing system, for the management of remote and home devices and represents a real central rehabilitation. It is able to connect in real time with every Khymeia device locally, including the Home Kit. This technology allows the therapist and the patient to work together on the rehabilitation process, with the same benefits of a face-to-face session. The system includes:
    - remote rehabilitation, where total control is possible, thanks to secure and encrypted videoconferencing and the possibility of taking control of the patient's device to verify the clinical data in real time;
    - remote monitoring, where thanks to the sensors included in the VRRS Home kit, the therapist can count on recordings of all movements and exercises that the patient has done while offline, in order to be able to make an objective assessment of their work and to correct them at the next face-to-face session;
    - the tele-consultation, where the therapist is able to evaluate the patient's situation with all the nuances, since the complete and fluid communication gives them the possibility to evaluate the emotional state of the patient, something which is fundamental for an effective rehabilitation process.
- The Physio (figure 5.4), equipped with the following rehabilitation modules, which can be carried out through the application of sensors:
    - Motor virtual rehabilitation module, including exercises for motor rehabilitation of all joints and segments of the body;
    - Postural virtual rehabilitation module, including tools such as:
        - the balance stand that is adaptable to the specific needs of the patient's rehabilitation programme and that can be used both for exercises in a standing position and in a sitting position at different heights. In this way the opportunities for rehabilitative uses are multiplied whilst being completely safe;
        - the stabometric and proprioceptive platform to measure the static stabometric (that is the oscillations of the subject in statics) and to carry out posturographic evaluations and the dynamic proprioceptive (i.e. the ability to perceive and recognise the position of your body in space and the state of contraction of your muscles), through an innovative method for the combined use in standing and sitting at different heights. This is therefore useful for improving the balance, autonomy and walking of patients.

    - Cardiorespiratory virtual rehabilitation module, that includes spirometry exercises for biofeedback (non-pharmacological treatment that allows you to learn to control body functions normally and involuntarily) and for the control of respiratory rate, inhalation and exhalation;
    - immersive and augmented virtual reality: it is an immersive virtual reality module organised for pathologies and rehabilitative activities with complex scenarios of ADL (activities of daily living).
- The Physio system is characterised by the vertical visualisation of rehabilitation scenarios for optimal patient immersion. The large vertical view allows ideal immersivity to maximise the benefits of augmented feedback. The solution includes full-body visualisation with extensive custom interaction options. Every activity of the patient is automatically recorded by the system, with the opportunity to view a 'replay' of the exercises performed, up to the most sophisticated analyses in graphic and numerical format. All the data can also be printed or exported in the most common formats. The reporting function is integrated into the patient profile. This is an extraordinary tool for analysis and evaluation and an exceptional system of objective monitoring of patient progress.
- The Compact, ideal for cognitive, speech and cardiorespiratory rehabilitation for outpatient clinical trials. It incorporates the VRRS operating system and allows the continuity of treatments carried out with HomeKit. It is fully compatible with the network connections of the Kloud system for the perfect management of the generated data. With Compact you get the contemporaneity of different rehabilitative modalities for different patients, with full control of the protocols and results that are at the same time uniform, from the service coordinators (a therapist, several patients).
- The HomeKit. The VRRS Home Tablet is the device that finally makes tele-rehabilitation possible at home. This includes not only cognitive tele-training, logopaedic, respiratory, but also motor training through the VRRS K-Wand and K-Sensor devices. The K-Wand is the innovative device for the motor rehabilitation of the upper limb and trunk and is equipped with an exclusive light recognition technology to detect movements in depth. The K-Sensor is the set of sensors used to perform the activities of motor telerehabilitation of the lower limb. Together with the VRRS K-Wand it is able to allow full body motor telerehabilitation. Exercises can be done in two different ways:

- online, where the therapist connects via the integrated videoconferencing and assumes remote control of the device at the patient's home, interacting with it in real time;
- offline, where the patient performs the personalised card of exercises, guided by the Smart Visual Assistant, which accompanies them in the interactive mode in real time throughout the duration of the training session.

All patient activities, even those performed independently offline, are automatically recorded and are always available to the therapist and other practitioners.


*Figure 5.1 – Khymeia VRRS EVO. Source: Khymeia.*


*Figure 5.2 – Khymeia HandBox. Source: Khymeia.*


*Figure 5.3 – Khymeia Tele CockPit. Source: Khymeia.*

*Figure 5.4 – Khymeia HomeKit. Source: Khymeia.*

Khymeia also offers two relevant services: the KLOUD and STRONG networks.

KLOUD is a cloud platform that is completely embeddable with healthcare records. It allows users to access the rehabilitation plans for the patients starting 'synchronous' remote rehabilitative sessions, such as videoconference sessions, the remote control of home devices and asynchronous activities as add-ons to the rehabilitative programs which are automatically downloaded onto the remote devices (i.e. the HomeKit), providing activity reports that are automatically uploaded to the platform by the device (Figure 5.5).

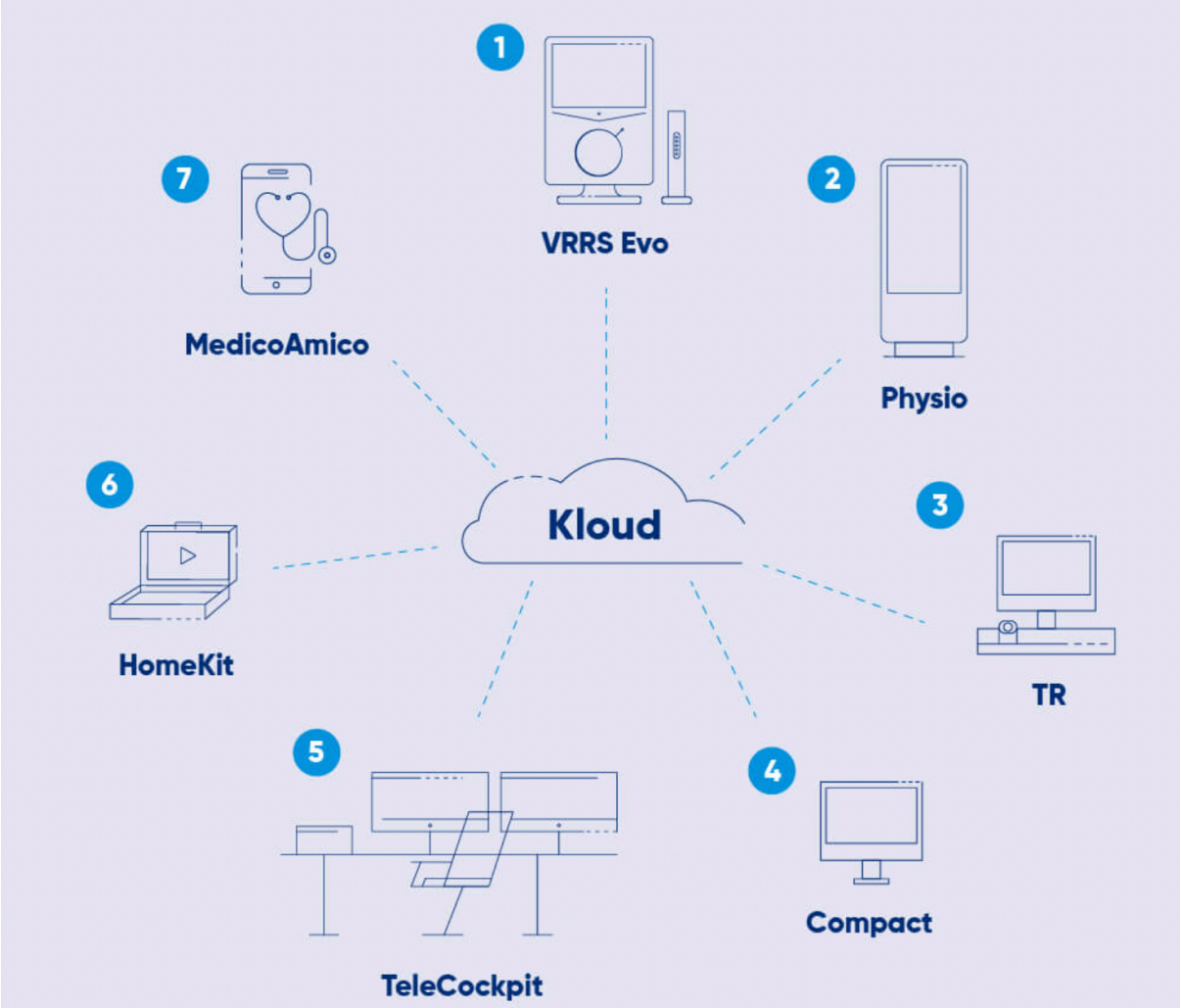


*Figure 5.5 – Khymeia KLOUD. Source: Khymeia.*

The platform is GDPR compliant, data is encrypted and secured on the backend cloud, on devices and while in transit. The organisation of roles allows for the clinical structure to be fully segregated, with the possibility to customise the privacy policy for each customer as an owner. Kloud takes all the security measures to ensure the resilience, backup and availability of data and applications (Art. 32, 33, 34 of the GDPR) and all the measures to ensure the rights of users pursuant to Art. 12-23 of the GDPR.

The STRONG network is a service implemented by KLOUD, which is a network made up of the best Italian and international clinical centres. The STRONG network allows Khymeia partners to cooperate with each other, sharing strategies and clinical data in order to improve procedures, participating in projects or scientific publications. The data collected, coming from the same technologies, are perfectly homogeneous, thus ensuring maximum management efficiency. The potential of this network is to design standard protocols to facilitate telerehabilitation implementation on a wider scale.

The platform and the network are proving to be very useful for different stakeholders, assuring a high quality of information and the engagement of the different actors (Nigro, Iannuzzi, Petracca & Del Vecchio, 2015). Imaging the future evolution of ecosystems' innovations as platform-based (Barile, Simone, Iandolo & Laudando, 2022), the role of digital technologies and platforms, such as Khymeia ones, will be decisive in the necessary evolution of healthcare.

## 5.3 Data collection

Data collected during this explorative analysis are:

- secondary data: collected through the analysis of materials related to the implemented Khymeia technologies. This phase has been carried on through several focus groups, meetings, and conferences during which the technologies have been presented and its functioning has been explained;
- primary data: collected while carrying out the in-depth interviews with the main stakeholders. The open interviews have been run on the base of the questionnaire developed in 4.7. During the first test of the questionnaire some issues has emerged related to the comprehension of the different shades of the considered variables and items, thus the decision to carry out open interviews instead of administering the questionnaire.

### 5.3.1 Focus groups and preliminary findings

Before the implementation of the technology, some focus groups have been created at Nuova CTA. The aim of this stage is to analyse the digital, physical, and social dimensions and the octant in which the service offering provided by Nuova CTA are placed. The focus groups have been run at first by the organisation's management and the medical director.

We insert, given these analysis, Nuova CTA offering in the Bolton cube (figure 5.6):

- The social presence of Nuova CTA is high. The project involves only the Nuova CTA business unit. The actors involved in the project are the medical director, 11 physiotherapists operating locally, 3 physicians, 1 speech therapist and 1 neuropsychomotor practitioner. With all the social health workers that interact with the patients on a daily basis, there are 40 members of staff involved in total. The high level of complexity is due to the type and the quantity of the interactions with the patient.

The Nuova CTA service offer is configured as patient-centered, with the aim of pursuing the humanisation of the treatment. Taking into account that most of the patients are affected by chronic illnesses (i.e. post stroke patients involved in rehabilitative care, and children with speech difficulties) the interactions are developed and pursued over the long term;

- The digital density of Nuova CTA before the adoption of the technology is medium/low. The facility is provided with a customised digital healthcare record system, in which all the information about the patients' and the physicians' activities are recorded. Some teleassistance activities are provided on a one-off basis through tools such as videoconferencing (i.e. when a patient in not able to attend the facility);
- The physical complexity is high. Starting with a first consideration on the geographical position of the facility, accessibility to it is low, making accessibility to care difficult. Indeed, the management is considering the possibility of opening another facility in a city which is more easily accessible. Some treatments are also provided on an at-home level, to reduce the barrier imposed by the geographical location. Further to this, the type of rehabilitative treatments provided by the facility needs a lot of tools to be performed, such as an equipped gym for motor rehabilitation, a series of objects and tools for neuro and speech rehabilitation.

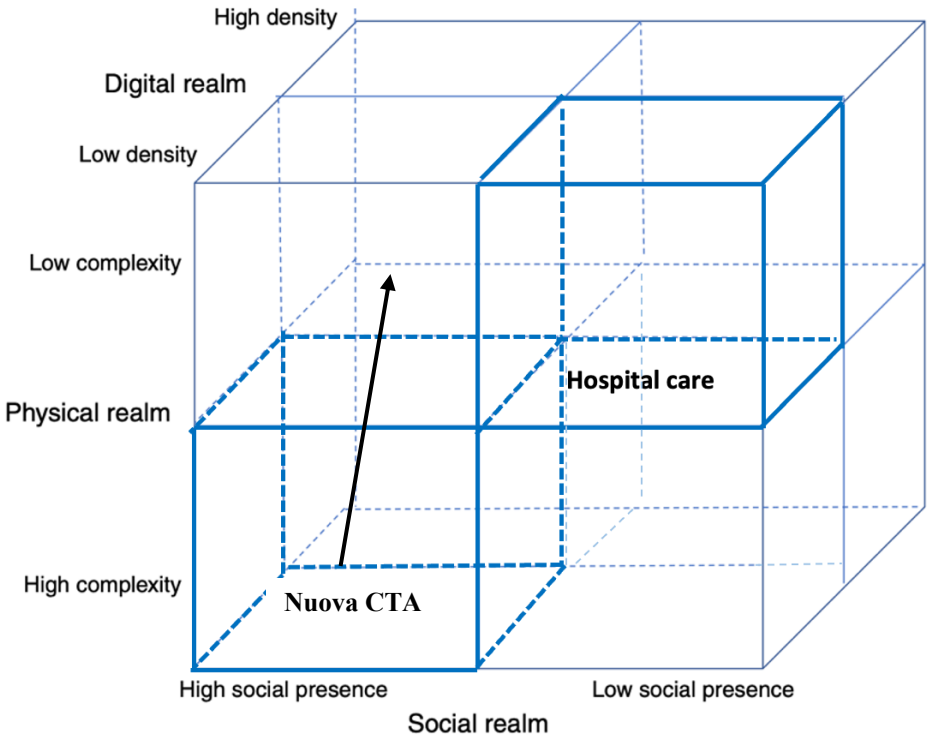


*Figure 5.6 – Nuova CTA in the Bolton cube. Author's elaboration.*

The octant in which Nuova CTA is placed before the implementation of the technologies is the same octant as community care, due to the very nature of the facility and its service offer.

Thus, the trajectory of evolution toward a higher digital density is investigated. During the focus groups, we tried to understand the first perception and propensity to the implementation of new telerehabilitation programmes.

According to Dr Fumai, the owner and manager of the facility, and Dr Infante, the Medical Director, the potential implementation of new technologies could represent a great opportunity in terms of:

- broadening the service offering;
- improving the level of care provision;
- improving the number of patients taken on;
- improving the management of the personnel and their training;
- bringing in external specialists that will provide remote consultations and healthcare services;
- involving specialists that are already established in the area;
- reducing accessibility barriers due to the geographical location of the facility.

The first impressions gathered are ones of enthusiasm and curiosity about the innovation. On the other hand, the management of the facility highlighted some concerns related to:

- the absence of an intermediate figure between the owners and the medical direction, such as a HR manager, who would be able to manage the personnel in the implementation stage;
- an issue of responsibility of the telerehabilitation treatment and the patient, which is headed by the medical director rather than by the practitioner providing the therapy;
- possible bureaucracy issues.

Given that not all the patients are eligible for telerehabilitation, the first idea is to move the activities related to speech therapy, psychomotor rehabilitation, simple neurological activities and simple neuromotor ones remotely, which could be controlled by the healthcare practitioners using remote technologies. Subsequently, it is clear that telerehabilitation cannot be implemented where manual intervention is needed.

The focus groups highlighted Nuova CTA's propensity towards new technologies, but the issue of the technology acceptance by the medical staff also arises.

### 5.3.2 Observation of the phase of implementation of the Khymeia technologies and training of the Nuova CTA staff

In the implementation and training phases we want to understand if the sentiment and the propensity of Nuova CTA personnel is aligned to that of the management and the owners of the facility. Following the installation and testing of Khymeia machines at Nuova CTA, training days for health workers were organised to fill the "technological gap" that still exists in the health sector, both for the acquisition of information regarding new equipment and to learn how to use it, including how it works, how the transmission technologies work and how data are processed and shared.

Reports have been collected during the training days which are useful to this research.

Khymeia's technical staff, made up of an engineer and a biotechnologist, demonstrated a lot of willingness to help and professionalism and took care of the explanation and illustration of the new digital technologies, highlighting the value, the countless possibilities for synergies and the potential of the system.

The staff interacted with Nuova CTA, using a specialised technical language and, at the same time, making it clear how such complex technological systems work. They illustrated, through a 'knowledge through experience' approach, the application of all the specific functionalities.

Indeed, after a first technical explanation, each member of the staff tried out the technology from a patient perspective, testing the sensors, the interface, and the exercises for each installed device.

During the first days of the training, the Nuova CTA personnel showed a proactive and collaborative attitude, together with a high level of anticipation.

While younger practitioners were not only accepting of, but also more able to intuitively use the technology (at ease to use the technology), the older members of the staff, who were also curious about the system, still found it difficult to follow all the procedures that were shown. Therefore, the latter, despite their initial enthusiasm, some fear and confusion were detected on the basis of their attitude and the questions asked (i.e. they asked to run more than one trial, if it would be possible to organise more training days, and so on).

During the training, some therapists were amazed to see all the data from the analyses produced after an exercise had been carried out (useful for the job/task). The information in the analysis seemed useful to them, such as the multiplicity of details and opportunities to personalise activities. Other operators, on the other hand, were surprised to see how the technology allowed them to have a complete follow up of the patient, enriched with all the details and trends obtainable from the various exercises.

A month after the first training, other training days were organised to deepen the knowledge of the technical and digital characteristics and potential of every single device.

In addition, these meetings were also organised to allow staff to acquire language properties and a practical familiarity with the new technology, thus they worked as facilitating activities for acceptance of the technology (facilitating conditions). During these days, healthcare practitioners also engaged in starting to ‘engage with’ the new technology more closely, practicing both alone and in simulations with other colleagues, creating test protocols to begin to become familiar with the purely technical/administrative aspect (behavioural intention to use).

### 5.3.3 In-depth interviews

After this training stage, in-depth interviews were scheduled and carried out.

The previous phase highlighted the necessity to deeper investigate the real perception of healthcare providers related to the acceptance of the new Khymeia technologies. The interview, carried out on the base of our synthesis of the different technology acceptance models, were done at a post-implementation stage of the telerehabilitation programmes.

In this phase it is crucial to understand, from a managerial outlook, the possible blockers, issues and the critical factors that come with the service innovation. This information, which was analysed through the VSA framework, is useful for the organisation (Siano et *al.*, 2012), in this case the management and the owners of the facility; and at a later stage, for local health authorities to improve the decision-making process. At the same time, these outcomes make it possible to improve the technology implementation process. These parameters are assessed not only in a technology acceptance view, but also with the aim of achieving effectiveness, efficiency, sustainability, and safety. Due to the very nature of healthcare, we initially have to ensure the quality of care and the efficiency (due to strict expenditure boundaries).

After the first assessment that the implemented telerehabilitation programs are non-inferior with respect to traditional rehabilitative programmes, the analysis should be done on both a systemic and a structural level.

The in-depth interviews with Nuova CTA personnel involved:

- 11 physiotherapists working at the patients' homes, of which 1 is already carrying out a first trial with the HomeKit case, which provides therapies for a specific type of patient, while other home physiotherapists do not yet use the new technology;
- 3 outpatient physiotherapists using the new technology at the centre;
- 1 outpatient speech therapist using the new technology at the centre, with initial attempts at remote rehabilitation;
- 1 outpatient psychotherapist using the new technology at the centre, with initial attempts at rehabilitation;
- 1 outpatient neuropsychomotor therapist using new technology at the centre.

The members of the group are between 30 and 60 years old.

A base questionnaire was produced defining the items for each construct. The questionnaire, which is available in Italian in Appendix I, was only tested to assess feasibility for use in a further stage of the research. On the other hand, represented a guideline for the in-depth interviews. All the extracts of the interviews are translated into English, as the interview was conducted in Italian. Answers are grouped according to the defined variables of:

- Attitude, perceived ease of use and behavioural intention to use;
- Usefulness for the job;
- Enrolled patients, their attitude towards the technology and caregivers' role;
- Perceived behavioural control/facilitating conditions.

## 5.4 Interviews findings

The discussion of the finding follows the synthesis model designed in 4.7, analysing the outcomes of the investigation related to the attitude toward the behaviour and to the subjective norms, given the open in-depth interviews run on the base of the developed questionnaire.

### *5.4.1 Interviews findings: attitude toward the behaviour*

The first group of questions are related to the users' attitude towards the Khymeia technologies and their colleagues' attitude. There were various answers:

A group of users had reported a positive attitude and a willingness to integrate innovation in their work, recognising the potential of improving service quality. A peculiar answer from one of the interviewees was literally "I'm thrilled". Another one answered: "I can't wait". These are qualitative measures of the positive attitude and of a high level of technology acceptance.

Another group reported a willingness to use the technology, but at the same time they were a little fearful and doubtful, considering themselves too old to learn how to use new tools.

Younger physicians, who are more willing to adopt new technologies, could be considered effective drivers for the implementation of telerehabilitation innovation. This is one of the first considerations that needs to be analysed on a wider sample base.

Going further with the investigation, some scepticism was highlighted amongst older colleagues, who were easily overwhelmed when it came to engaging with and trying out the technology. The consideration is that the novelty of the technology inspired a sentiment of inadequacy, and they were overwhelmed by knowledge (Caputo et *al.*, 2019).

Each interview led to proof concerning the relationship between the physical dimension of the care process and the digital one. Digital elements are seen as a supportive tool in an integration view. The interpretative hypothesis of the inconsistency of the digital/physical dilemma, rather the necessity to interpret healthcare service innovation as a digital/cognitive paradigm in which the attention is focused on the cognitive dimension of the interaction, as expressed in 3.4, is somehow confirmed in practice. Indeed, according to the interviewees, the physical and digital dimensions of care should be balanced one with the other.

For some physicians, however, the traditional rehabilitation should have a more relevant role with respect to telerehabilitation. They stated that: "tele-rehabilitation cannot replace traditional in person therapy, but it should be considered when the patient cannot access standard rehabilitation. Wherever possible, traditional therapy should be preferred because

empathy and human interactions are fundamental. The feeling of safety felt by the patient is enabled by the physical presence of the healthcare provider, and it is something that cannot be performed through remote programmes".

Some members stated that the humanization of the therapy should be defended, "not resulting in alienation and apathy".

Physicians, thus, suggest integrating remote sessions and in-person ones, because "the patient needs to have a face-to-face interaction with the practitioners".

The perception of the usefulness of telerehabilitation is positive. In particular, a young practitioner who was interviews, whose patients are very young, stated that "I think telerehabilitation can be useful because, working mainly with patients of developmental age, I realise that kids are very attracted by these technologies. They prefer and pay more attention to multimedia materials rather than to paper ones and are already accustomed to touchscreens and to the digital dimension. Running remote treatments through digital technology is therefore more attractive to them and they are more motivated".

This has also proven true for other practitioners: "Kids are enlightened because they are interested in gaming and so they are definitely more stimulated".

Telerehabilitation based on gaming, indeed, provides the patient with countless scenarios and environments, in which success can be customised and graduated according to capabilities, ensuring greater motivation to complete the task and the numerous tests needed to master the movement (Lange B., et al, 2009).

It is important to note that these innovations allow users to become the main actors of their care programme (Cranen K., et al, 2017). The latter are, thus, in a position to assume an active role in decision-making and disease management, resulting in improved overall health awareness, adherence to treatment and satisfaction (Wang X., et al, 2019), and therefore becoming value co-creators.

Most of the users analysed the usefulness of Khymeia technologies in relation to the way in which they provide the treatment. Some of them consider telerehabilitation useful because:

- it allows them to "understand the actual performance of a patient through graphics and data";
- it "lightens the physical burden of the therapist" allowing them "to preserve their physical energy";
- it allows a sort of "physical break for the therapist who can then work differently";
- though telerehabilitation they are able to "improve their performance since it also makes them more aware of mistakes during use";

- it can make the therapist's work "less monotonous and richer in stimuli";
- it can make "repetitive activities always different somehow".

### 5.4.2 Interviews findings: subjective norms

Some questions on the patients chosen on an eligibility basis for the remote treatment were put forward. *"The target is firstly made up of children and people of different ages, with a satisfactory cognitive capability and with the ability to interact with both the equipment and the therapist".* Other users, especially at a local level, however, state that they currently do not have patients who would be able to use telerehabilitation technologies, as they are people who are bedridden with serious neurodegenerative diseases that are highly disabling.

The speech therapist reported that she couldn't extend the technology to all her patients because she realised that "it is effective for some patients and not for others. For example, for patients with attention, speech or motor disorders it proves to be very useful. On the other hand, very hyperactive patients, who find it difficult to do the same activity for long periods of time, and for patients with low-functioning autism, a more playful and face-to-face intervention is necessary. For the latter, I do not consider it suitable, at the moment. So, everything depends on age, pathology and the severity thereof".

Focusing the healthcare staff's attention onto the attitude observed in their patients to the introduction of new technology, the patient approach was very positive, especially for young people because, in addition to an "easy, understandable, engaging, realistic" interface, there is visual and sound feedback, as the final applause to each completed activity that increases and strengthen "motivation and gratification". The enthusiasm and engagement of some patients in the activities was also perceived by the negative reaction with "anger and shouting" for non-accomplished tasks, which manifested when the therapist showed up without the HomeKit technology.

Some users, in thinking about the types of their patients, have assumed that tele rehabilitation would be positively accepted by those who "do not want to move because in the house they feel safe". This clear evidence of the feeling of safety emerged in the literature too. This response, however, would not have had the same positive outcome in those who consider "therapy an opportunity to go out, to have fun and to meet other people". Thus, the social role of the interaction between the patient and the healthcare provider. Here too, it is stressed that everything depends on the patients' character and the established social relationships.

Patients' approach to service innovation has also been observed in relation to the setting (physical dimension), which, with this method, is no longer "therapeutic or neutral", but certainly more "confidential". This means that different variables can affect the therapy session, such as an informal environment that generates more distraction and the presence of people with whom the patient has a definitively more familiar relationship, compared to the relationship between the patient and their therapist.

Regarding this topic, from the interviews, two diametrically opposite views emerged:

- In some cases, patients in home settings were distracted by other stimuli, while the same drop in attention was not noticed in the outpatient setting.
- In other situations, the patients, in the home setting "were able to settle into the dynamic of doing therapy faster by being in an environment familiar to them, while a phase of adjustment was necessary before starting the session in the facility".

Regarding the figure of the caregiver, different visions emerged on the basis of the personal experiences of each user.

- Community physicians have specified that they could not "rely" on patients' caregivers, as they spend the time during which the patient is involved in the therapy to do other activities;
- In other cases, caregivers would not be able to be supportive because they are elderly or foreign;
- In other situations, they represent a barrier to the therapist, being "oppressive, cumbersome and not supportive";
- In certain situations, caregivers "are not yet available either at a cognitive level or at an organisational one", finding it more convenient thus far to bring patients to the centre rather than standing next to them with their briefcase at home because "we care more that the therapy is carried out in the outpatient setting", due to being "accustomed to the classic patient/therapist therapy";
- Physicians also reported telerehabilitation being proposed to some caregivers that initially accepted the possibility of remote care, but then refused it because they "still think therapy is more effective when there is a face-to-face interaction with the therapist".

For all the reasons mentioned above, healthcare professionals overall believe that it is absolutely necessary to properly train and inform caregivers in order to make them valid drivers and active supporters of virtual remote therapy. In this perspective, telerehabilitation can also

be an opportunity for caregivers to learn by “indirectly obtaining instructions and useful information to be reproduced in the daily life of the patient”.

In relation to the questions regarding the effectiveness of telerehabilitation, very positive results emerged. Users believe that, in this way, immediate feedback can be obtained in relation to the work done during therapy and in relation to the exercises performed by the patient. Users perceive evaluations as “much more real, immediate, objective, accurate, reliable and allow trends and parameters to be acquired for comparison over time”.

The outcomes of the interviews provided eye-opening information about the evident advantages of performing therapy in remote:

- The availability of immediate visual feedbacks “which allows both the therapist and the patient to understand if the exercise is being performed correctly or not”;
- The possibility to perform various exercises suggested by the technology “that they would not have thought of otherwise”;
- The achievement of the final goal “with different exercises and multiple programmes”;
- The possibility of carrying out activities in an “active manner by the patient and not in a sterile manner”;
- The comprehensiveness of the exercises, thanks to the sensors, enabling more in-depth details to be acquired. In particular, a therapist reported that it is possible to see the bending of the elbow by placing a sensor at the height of the bicep and a sensor at the polar height of the forearm and moving them closer and further apart, getting “quantity, excursion, and above all, the articular width of the elbow”;
- The possibility of inserting “other supports, such as weights and elastic bands, which make the therapy session more dynamic”;
- The direct and visual communication provided by the technology about the incorrect execution of the exercise becomes a supporting element for verbal interaction;
- The opportunity to modify the difficulty level of the exercises to “personalise them and adapt them to patients”;
- The economic and time-saving results of remote rehabilitation, allowing the patient “not to attend the facility feeling distant and disoriented, but to do activities directly at home with the constant supervision of the therapist”;
- The possibility of performing free exercises at home offline that are recorded and then evaluated by the therapist, “increasing the patients’ willingness and the attention given to carrying out the activities, knowing that they are later evaluated by the professional”.

Some criticalities have also emerged that the practitioner could be unfamiliar with, concerning the need to encourage people that telerehabilitation means "in any case and specifically to carry out therapy", despite the physician being cognitively present remotely. In this view, it aims to bring patients around to the understanding that innovative devices or digital technologies should not be seen as "a distinct method of care, but rather used as an aid/add-on to fill gaps or accelerate efficiency in existing healthcare delivery systems" (Wang X., et al, 2019). The ambition is to enable patients to consider telerehabilitation as an equivalent, if not even preferable, to being provided directly home-based. To do so, the necessary step is to free patients from the prejudices of something which is not yet experienced or known. The reported feedback is:

- not feeling confident about the briefcase, especially "when connecting and switching it on";
- the small screen size included in the case that "is not suitable for patients with vision problems during treatment". Because of this, physicians have to connect the briefcase to a TV screen to allow the patient to see the exercises better. This shows that users "find solutions at the time that do not sacrifice the use of technology due to technical/instrumental difficulties".
- The procedure is too long due to organisational issues or unforeseen events.

This leads some therapists to consider *"traditional manual therapy definitely more immediate"* when, for example, there isn't the necessary presence of a caregiver to *"turn on the case and connect the sensors for patients who are alone".*

During the interviews, effectiveness improvements have been reported by physicians, due to the use of the new Khymeia technologies, such as:

- slight improvement on a particular movement when using the briefcase at home because it was performed more easily by the patient;
- *"some improvements in effectiveness with a particular child with problems in giving change with exercises based on counting money and the change, they were able to perform them better whilst also gaining confidence".*

Also, efficiency improvements have been reported: some users have found this by having "instant and direct feedback" of the performance, having the possibility to check the mistakes "if the patient did not give the right performance" so as to "act immediately to correct them with suitable motor diagrams".

## 5.4 General findings of the case study

It can be said that the implementation of advanced technologies for healthcare could not occur without pros and cons. The analysis has, indeed, highlighted the possible benefits coming from the implementation of such technologies and in remote therapeutic paths, and also the possible obstacles to the affirmation of the same.

Analysing the patient side, given that not all the patients are eligible for telerehabilitative protocols, it could be said that factors such as age, gender, kind of pathology, its severity, the availability of a caregiver, and so on, could affect the acceptance of the technology. Another factor that affects the acceptability is also the character of the patient and of his/her caregiver. While on the one hand younger patient are more familiar to certain digital tools, on the other hand some children could also be distracted by the digital interface, thus the remote treatment does not prove effective.

Dealing with practitioners' side evidence, it could be said that the age is a factor that affects the acceptance of the technology, being that younger people are more familiar with digital means. Older practitioners, indeed, could present a little scepticism, that could be easily overcome through the enhancement of knowledge related to the technology and its functioning (as the practitioner becomes more familiar with the digital instrument).

What has emerged, once the team started to be keen on the technology, is that telerehabilitation technologies are useful for the job, making it easier and allowing practitioners to bettering the management of the work. One of the most relevant findings is that practitioners do not look at new digital technologies as an alternative to traditional treatments. Rather, digital technologies are conceived by the staff as integrated to in person and traditional therapies, highlighting the hypotheses already developed in the third chapter related to the overcoming of the digital/physical dilemma, embracing a paradigmatic view of the physical and digital dimensions of the care.

In this way, given the technologies, telerehabilitation facilitates the customization of the therapeutic path and treatment, somehow enhancing the engagement of the patients, that become more motivated to adherent the therapy. The amount of data derived and processed by a network innovation such as the VRSS analysed in this research, indeed, are useful not only for the physicians, but also for patients and caregivers, which become aware of both errors and improvements. The more relevant issues derived are at a structural level, such as the suitability of the home-based setting and bureaucracy.

The necessary evolution toward community and proximity-based healthcare provision is closer and closer.

## 5.5 Limitations of the study

This study comes with some limitation. A first necessary consideration is that the study, initially, was supposed to be on telerehabilitation. Because of the impossibility, manifested when the study was already underway, to carry out experimental protocols of telerehabilitation in Salerno province, the study had to be related to the use of advanced technologies for rehabilitation.

Telerehabilitation protocols, to date, are carried out experimentally and are active in many Italian regions. However, in Campania, the ASL of Salerno has not yet given permission for the trial. This also happened in the case study of the Nuova CTA. Therefore, although the structure begun a collaboration with the company Khymeia, supplier of the technology, implementing all the necessary technologies for activating the protocols, the ASL of Salerno has not given its green light to start. However, the facility, having installed the technologies, carried out staff training and selected eligible patients for remote protocols, decided to use rhe advanced implemented technologies to pursue enhanced rehabilitation protocols. In this way it was possible not to waste the opportunity to start experimenting Khymeia technologies, consolidating the knowledge of the same and the skills of operators about their use. Thus, the staff was able to thoroughly test the new tools, to bring patients and caregivers closer to it, facilitating the acceptance of remote rehabilitation technologies. From the limitations of this study came a possible new interpretation of the use of technology for remote therapeutic protocols. To promote the necessary evolution towards the territory, a phase in which traditional rehabilitation protocols evolve thanks to the use of advanced technologies could be interpreted as a determining factor to promote this transition, making it effective, efficient, and sustainable.

Another limitation of the study is due to the literature review, because of the tool chosen for the bibliometric analysis. If, on the one hand, the choice of conducting a bibliometric analysis of literature was due to the need to map very wide areas of knowledge, this kind of analysis, because of its very nature, presents losses of information, that we have tried to reduce through an in-depth study of the works in the research databases. Information loss, therefore, reduced, but not discarded.

The peculiarity of the analysis context, also, forced the research team to readjust the investigation where there were no suitable conditions to carry out the analysis in serene conditions. Given the purely exploratory nature of the empirical investigation, what has emerged is particularly useful for the preliminary interpretation of the problem and the formulation of interpretative hypotheses for the progress of the study and for possible future evolutionary directions. An example is the emerging possible and interesting hypothesis for future trajectories of the research related to the role that virtual rehabilitation (the Physio) and the rehabilitation carried out with the use of advanced technologies (the home kit used in the home setting with physicians) could have in facilitating the acceptance and the effectiveness of remote digital technologies (telerehabilitation).

## CONCLUDING REMARKS

As proven in the reporting and discussion of evidence in the previous paragraph, the opportunities arising from the implementation of telerehabilitation programmes are multiple.

The interviews, aimed at investigating the first opinions and acceptability of new service innovation in healthcare in an explorative stage, have been eye-opening. The outcomes related to the behaviour of both patients and users in implementing Khymeia technologies, and their propensity to doing so highlighted that even if the initial attitude and willingness is positive, the presence of an important variety and multiplicity of responses also indicated initial sentiments of scepticism, disorientation, and confusion.

The approach is ambivalent, oscillating between enthusiasm and fear, confirming that the implementation of new technology mandatorily passes through the systemic level, thus the way in which different actors react to the service innovation and then interact with each other during the implementation phase.

The process of service innovation in healthcare, aimed at using new technologies to pursue a community and home-based model, is complex, slow, and delicate.

The understanding of the technology acceptance, both on the providers' and on the patients' side, is crucial to inform decision-makers to pursue strategies aimed at promoting the implementation of new instruments. In the case study, due to the fact that the Nuova CTA is a facility run and managed by a private owner, information sharing of the outcomes coming from different stages of implementation has been easier. While moving to a wider context, such as the Local Healthcare Authorities, the process could become more complex.

The investigation on TAM is also necessary to understanding all the complexity elements and which are the factors that could enable or block the evolution towards a higher level of digital density.

As seen in the Nuova CTA case, there are many different blocks:

- Scepticism of the medical staff that could believe the traditional care provision models are more effective and easier, not seeing the potential of the innovation;
- Patients could be scared by a new system and by the inconsistent physic/digital dilemma;
- Patients might prefer traditional therapy seeing it as a social occasion to leave their home;
- Caregivers could be unsupportive;

- At an organisational level, the necessary bureaucracy to activate the telemedicine treatment could be very slow and difficult, encouraging traditional care or provision through private facilities;
- Some regions do not have, to date, DRGs for telemedicine;
- The necessary involvement of different actors at a macro level could also represent a blocking factor;
- The PNRR actions are focused on structural implementation and not on the empowerment and strengthening of the human resources involved in the care process.

Some of these issues could be easily overcome by:

- Training personnel in order to understand the technology and its usage, believing in its implementation and understanding the arising opportunities;
- Training patients, involving them in a more dynamic interaction, which is patient-based and that paves the way for customisation;
- Sharing knowledge with and training caregivers in order to make them a more active part of the process;
- Creating networks of knowledge sharing for practitioners.

As it emerged, whilst on a micro and systemic level there are some positive and enabling conditions to implement telemedicine programmes (despite them are not enough), at a macro and structural level there are too many blockers, of which bureaucracy, the non-yet implemented digital health record system and structural unpreparedness are the most important.

Thus, we may conclude that in theory the Italian NHS is ready to implement service innovations for the necessary transition towards the healthcare of the future based on local and community care. In practice, the time for that hasn't come yet and a prior evolution of the system, functional to the one shaped in the PNRR, is necessary, both at the structural and at the systemic levels.

## MANAGERIAL IMPLICATIONS AND FUTURE DIRECTIONS OF RESEARCH

Further research should be done with an institutional partner, such as the Local Health Authority of Salerno (ASL of Salerno), with which the intention to continue the trial has already been discussed.

In this context, the research should be done in a non-explorative way on a wider range of facilities, remotely provided services, practitioners, patients, and caregivers. Future

investigation should be related not only to the acceptance of telerehabilitation technologies (remote digital technologies), but also on the possible mediating role of virtual rehabilitation and of advanced technologies applied to the traditional provision of rehabilitative care to enhance and facilitate the acceptance and effectiveness of remote digital technologies.

The aims of further investigations are to better assess the problem on a structural level, also.

The questionnaire should be articulate in its different versions, each of which being aimed at different actors (such as doctors, nurses, social workers, patients, caregivers, healthcare management) with the aim of understanding whether the evidence from the first explorative investigation proves true at the local authority level or not, and defining which are the real blockers and enablers of remote care.

Procedures aimed at carrying out technology acceptance assessment should be also defined, together with a specific procedure to inform decisions makers about the determining factors that allow the implementation of service innovation in healthcare.

# APPENDIXES

## APPENDIX I – Overlay network visualization – first level literature review

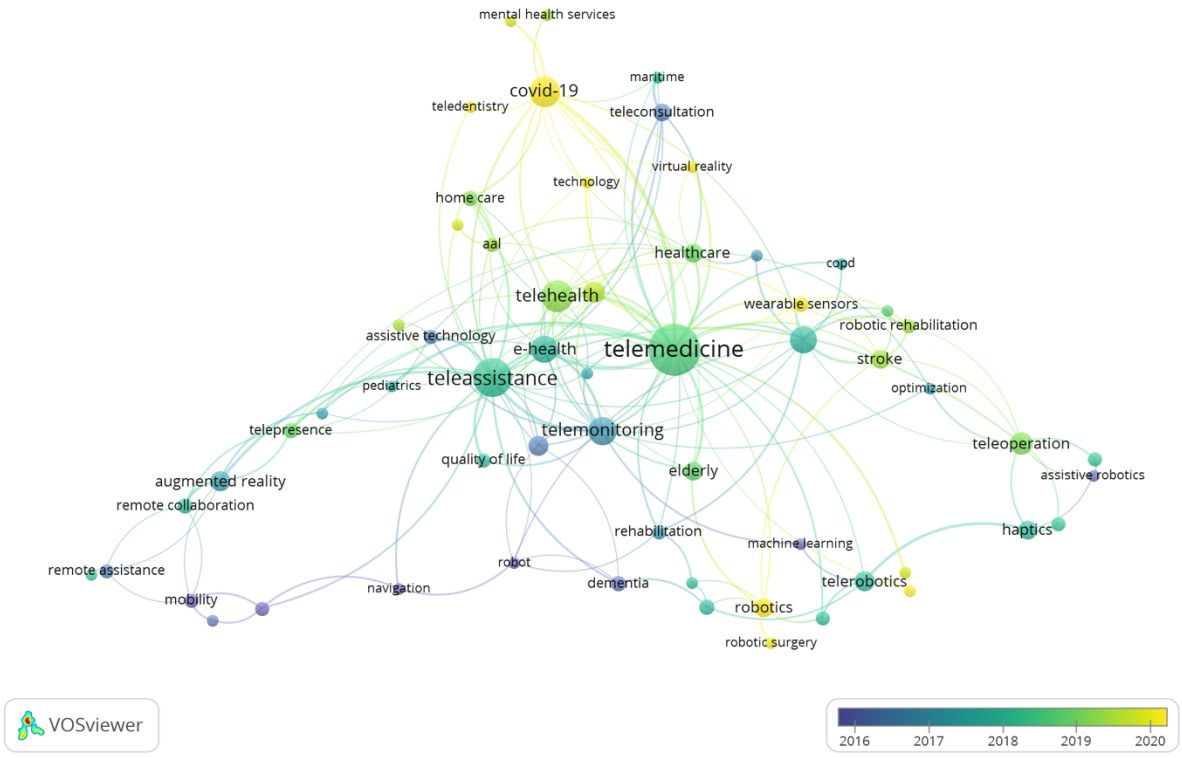


Figure 6.1 - Vosviewer keywords co-occurrence map of teleassistance query - overlay visualization

## APPENDIX II – Questionnaire

The questionnaire has the sections and the items in English, as it is the language of this work. The questions have been written as administered in Italian due to the target respondents.

**Perceived usefulness**

- Useful for job (or task)
    1. "Credo che la tele riabilitazione sia utile allo svolgimento delle attività necessarie ai fini del recupero della salute psicofisica (e/o dei singoli task)". Risponda indicando da 1 a 7 quanto è d'accordo con l'affermazione (1 per nulla, 7 totalmente d'accordo)
    2. Sono propenso a utilizzare nuove tecnologie per svolgere le attività necessarie ai fini del recupero della salute psicofisica". Risponda indicando da 1 a 7 quanto è d'accordo con l'affermazione (1 per nulla, 7 totalmente d'accordo)
    3. "Credo che la tele riabilitazione renda più semplice attività necessarie ai fini del recupero della salute psicofisica". Risponda indicando da 1 a 7 quanto è d'accordo con l'affermazione (1 per nulla, 7 totalmente d'accordo)
    4. "Credo che la tele riabilitazione mi permetta di completare le attività necessarie ai fini del recupero della salute psicofisica più velocemente". Risponda indicando da 1 a 7 quanto è d'accordo con l'affermazione (1 per nulla, 7 totalmente d'accordo)
    5. "Credo che la tele riabilitazione migliori la qualità delle attività necessarie ai fini del recupero della salute psicofisica". Risponda indicando da 1 a 7 quanto è d'accordo con l'affermazione (1 per nulla, 7 totalmente d'accordo)
    6. "Credo che la tele riabilitazione sia più utile per erogare la prestazione a confronto con le tecnologie meno innovative". Risponda indicando da 1 a 7 quanto è d'accordo con l'affermazione (1 per nulla, 7 totalmente d'accordo)
- Increases productivity
    7. "Credo che l'utilizzo la tele riabilitazione possa aumentare la mia efficacia nello svolgimento delle attività necessarie ai fini del recupero della salute psicofisica". Risponda indicando da 1 a 7 quanto è d'accordo con l'affermazione (1 per nulla, 7 totalmente d'accordo)
    8. "Credo che l'utilizzo della tele riabilitazione possa migliorare le mie prestazioni nello svolgimento delle attività necessarie ai fini del recupero della salute

psicofisica". Risponda indicando da 1 a 7 quanto è d'accordo con l'affermazione (1 per nulla, 7 totalmente d'accordo)

9. "Credo che l'utilizzo della tele riabilitazione possa far migliorare le prestazioni assistenziali erogate dalla struttura Nuova CTA". Risponda indicando da 1 a 7 quanto è d'accordo con l'affermazione (1 per nulla, 7 totalmente d'accordo)
10. "Credo che l'utilizzo della tele riabilitazione possa supportarmi nell'affrontare gli aspetti più critici nello svolgimento delle attività necessarie ai fini del recupero della salute psicofisica". Risponda indicando da 1 a 7 quanto è d'accordo con l'affermazione (1 per nulla, 7 totalmente d'accordo)

- Enhances effectiveness of job (or work)
  11. "Credo che la tele riabilitazione possa aumentare l'efficacia delle attività necessarie ai fini del recupero della salute psicofisica" Risponda indicando da 1 a 7 quanto è d'accordo con l'affermazione (1 per nulla, 7 totalmente d'accordo)
  12. "Credo che l'utilizzo della tele riabilitazione possa far migliorare la gestione dei pazienti da parte della struttura Nuova CTA". Risponda indicando da 1 a 7 quanto è d'accordo con l'affermazione (1 per nulla, 7 totalmente d'accordo)
- Allows tasks to be accomplished more quickly
  13. "Credo che l'utilizzo della tele riabilitazione mi permetta di svolgere più rapidamente le attività necessarie ai fini del recupero della salute psicofisica". Risponda indicando da 1 a 7 quanto è d'accordo con l'affermazione (1 per nulla, 7 totalmente d'accordo)
- Improves job performance
  14. "Credo che l'utilizzo della tele riabilitazione possa permettermi di migliorare le mie performance nello svolgimento delle attività necessarie ai fini del recupero della salute psicofisica". Risponda indicando da 1 a 7 quanto è d'accordo con l'affermazione (1 per nulla, 7 totalmente d'accordo)
- Makes it easier to do job/work
  15. "Credo che l'utilizzo della tele riabilitazione possa rendere più facile lo svolgimento delle attività necessarie ai fini del recupero della salute psicofisica". Risponda indicando da 1 a 7 quanto è d'accordo con l'affermazione (1 per nulla, 7 totalmente d'accordo)
- Increases quality of care

16. “Credo che l’utilizzo tele riabilitazione possa di migliorare la qualità delle prestazioni assistenziali in ambito sanitario”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)

- Increases quality of work
    17. “Credo che la tele riabilitazione possa migliorare la qualità nello svolgimento delle attività necessarie ai fini del recupero della salute psicofisica”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Improves work efficiency
    18. “Credo che la tele riabilitazione permetta di svolgere le attività necessarie ai fini del recupero della salute psicofisica in modo più efficiente”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Allows tasks to be done more accurately
    19. “Credo che la tele riabilitazione permetta di svolgere le attività necessarie ai fini del recupero della salute psicofisica in modo più accurato”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Allows tasks to be done more objectively
    20. “Credo che la tele riabilitazione permetta di svolgere le attività necessarie ai fini del recupero della salute psicofisica in modo più oggettivo”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Supports critical aspects of job
    21. “Credo che la tele riabilitazione agevoli la gestione nello svolgimento delle attività più critiche ai fini del recupero della salute psicofisica”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo) – Chiarire cosa si intende per “attività più critiche”
- Increases chance of getting a raise
    22. “Credo che la tele riabilitazione consenta di ottenere risultati migliori nello svolgimento delle attività necessarie ai fini del recupero della salute psicofisica”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Allows greater control over work

23. “Credo che la tele riabilitazione permetta di controllare/gestire meglio le attività necessarie ai fini del recupero della salute psicofisica”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)

- Enables decisions based on better evidence
  24. “Credo che la tele riabilitazione permetta di prendere decisioni basate su migliori evidenze”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Improves patient care and management
  25. “Credo la tele riabilitazione permetta di migliorare la cura e la gestione del paziente”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
  26. “Credo che la tele riabilitazione renda più semplici le attività di cura e gestione del paziente”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)

**Perceived ease of use**

- Easy to use
  1. “Credo che la tele riabilitazione sia facile da utilizzare”. Risponda indicando da a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Clear and understandable
  2. “Credo che la tele riabilitazione sia chiara e comprensibile”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Easy to become skillful with system
  3. “Credo che per me possa essere facile diventare abile nell’uso della tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Easy to get it to do what you want it to
  4. “Credo che per me possa essere facile adattare la tele riabilitazione alle mie necessità specifiche”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Easy to learn to operate
  5. “Credo che, per me, imparare a utilizzare la tele riabilitazione NON sarebbe semplice”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)

- Flexible to use/interact with
  6. “Credo che la tele riabilitazione si adatti alle diverse esigenze”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Low mental effort
  7. “Credo che la tele riabilitazione richieda un minimo sforzo mentale”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Easy to do what I want
  8. “Credo che sia semplice realizzare quello che mi sono prefisso grazie alla tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Easy to do tasks with system
  9. “Credo che sia semplice svolgere le attività necessarie ai fini del recupero della salute psicofisica grazie alla tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Understandable
  10. “Credo che l’utilizzo della tele riabilitazione sia comprensibile”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Does not demand much care and attention
  11. “Credo che l’utilizzo della tele riabilitazione non richieda troppo impegno e attenzione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Navigation is easy
  12. “Credo che l’interfaccia della tele riabilitazionesia di facile utilizzo”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Easy to remember how to perform tasks with system
  13. “Credo che, per me, sia facile ricordare come svolgere le attività necessarie ai fini del recupero della salute psicofisica tramite la tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)

**Social influence/subjective norms**

- Doctors who influence my behavior think I should use system
    1. “I medici che influenzano i miei comportamenti pensano che dovrei utilizzare tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo) – 6 (spiegare meglio cosa si intende per “medici che influenzano i miei comportamenti”)
- Doctors who are important to me think I should use system
    2. “I medici che sono importanti per me pensano che dovrei utilizzare la tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- People who influence my behavior think I should use system
    3. “Le persone che influenzano i miei comportamenti / hanno un’influenza sulla mia attività pensano che dovrei utilizzare tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- People who influence my clinical behavior think I should use system
    4. “Le persone che influenzano la mia pratica clinica / hanno un’influenza sulla mia clinica pensano che dovrei utilizzare la tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo) (spiegare meglio cosa si intende per persone che influenzano la pratica clinica)
- People who are important to me think I should use system
    5. “Le persone che sono importanti per me pensano che dovrei utilizzare la tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- People whose opinions I value think I should use system
    6. “Le persone di cui stimo le opinioni pensano che dovrei utilizzare la tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- People who are important to my health care services think I should use system
    7. “Le persone che sono importanti rispetto alle mie prestazioni di assistenza sanitaria pensano che dovrei utilizzare la tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- People who are important in assessing my patient care and management think I should use

8. “Le persone che sono importanti nella valutazione delle mie capacità di assistenza e gestione dei pazienti pensano che dovrei utilizzare la tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)

- Senior management of hospital has been helpful
  9. “Il management di Nuova CTA è stato d’aiuto nel processo di adozione della tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Hospital supported use of system
  10. “Le strutture sanitarie territoriali promuovono l’adozione della tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Colleagues who are important to me think I should use system
  11. “I colleghi che sono importanti per me pensano che dovrei utilizzare la tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Superiors at work think I should use system
  12. “I miei superiori pensano che dovrei utilizzare la tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Subordinates at work think I should use system
  13. “I miei subordinati pensano che dovrei utilizzare la tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)

**Perceived behavioral control/facilitating conditions**

- Have necessary resources to use system
  1. “Dispongo delle risorse (monetarie, di tempo, di conoscenza) necessarie per utilizzare la tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Have knowledge to use system
  2. “Ho le conoscenze necessarie per utilizzare la tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)

- Compatibility with other systems
    3. “La tele riabilitazione è compatibile con gli altri sistemi presenti nella struttura”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Availability of technical assistance
    4. “È possibile disporre di assistenza tecnica nell’uso della tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Able to use system for patient care and management
    5. “Sono in grado di utilizzare la tele riabilitazione nelle mie attività di assistenza e gestione del paziente”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Using system at work is wise
    6. “Utilizzare la tele riabilitazione nel mio lavoro è una scelta saggia”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Using system entirely under my control
    7. “L’utilizzo della tele riabilitazione è totalmente sotto il mio controllo”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)

**Behavioural Intention to use (“Acceptance”)**

- Given the chance, I intend to use described device for tele-rehabilitation
    1. “Avendone la possibilità, intendo utilizzare la teleriabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- I am willing to use described device for tele-rehabilitation in the near future
    2. “Sono disposto ad utilizzare la teleriabilitazione nel prossimo futuro”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- I will frequently use described device for tele-rehabilitation
    3. “Se necessario, userò spesso la teleriabilitazione in futuro”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- I will recommend described device for tele-rehabilitation to others

4. “Consiglierò di utilizzare la teleriabilitazione ad altri”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)

**Patients' satisfaction14**

- Ease of registration/scheduling
  1. “Credo che sia semplice registrarsi e programmare le prestazioni tramite la tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Quality of the visual image
  2. “Sono soddisfatto della qualità delle immagini della tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Quality of the audio sound
  3. “Sono soddisfatto della qualità del suono della tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- Ability to talk freely over telemedicine
  4. “Riguardo la telemedicina, utilizzata per facilitare l’assistenza sanitaria durante la pandemia COVID-19, sono molto soddisfatto riguardo la possibilità di parlare liberamente” (1 per nulla, 7 totalmente d’accordo) [15]
- Ability to understand the recommendations or diagnosis made
  5. “La tele riabilitazione permette di comprendere i suggerimenti e le diagnosi fatte”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- The comfort of the telemedicine suite (the location where I received my care)
  6. “La tele riabilitazione permette di erogare le prestazioni assistenziali in un luogo confortevole per il paziente”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)
- The overall quality of care provided

14 This section has not be tested yet.

[15] Adaptation from: Nasser, A. A., Alzahrani, R. M., Fellah, C. A., Jreash, D. M., Almuwallad, N. T. A., Bakulka, D. S. A., & Abed, R. A. R. O. (2021). Measuring the patients’ satisfaction about telemedicine used in Saudi Arabia during COVID-19 pandemic. Cureus, 13(2).

7. “Sono soddisfatto della qualità generale delle prestazioni offerte tramite la tele riabilitazione”. Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)

- Overall telemedicine consult experience
    8. “Sono soddisfatto dell’esperienza di consulto a distanza, possibile grazie alla tele riabilitazione” Risponda indicando da 1 a 7 quanto è d’accordo con l’affermazione (1 per nulla, 7 totalmente d’accordo)

## Bibliography


Abdekhoda, M., Ahmadi, M., Gohari, M., & Noruzi, A. (2015). The effects of organizational contextual factors on physicians' attitude toward adoption of Electronic Medical Records. Journal of Biomedical Informatics, 53, 174-179.

Agostini, M., Moja, L., Banzi, R., Pistotti, V., Tonin, P., Venneri, A., & Turolla, A. (2015). Telerehabilitation and recovery of motor function: a systematic review and meta-analysis. Journal of telemedicine and telecare, 21(4), 202-213.

Alaboudi, A., Atkins, A., Sharp, B., Balkhair, A., Alzahrani, M., & Sunbul, T. (2016). Barriers and challenges in adopting Saudi telemedicine network: The perceptions of decision makers of healthcare facilities in Saudi Arabia. Journal of Infection and Public Health, 9(6), 725-733.

Alaiad, A., & Zhou, L. (2014). The determinants of home healthcare robots adoption: An empirical investigation. International Journal of Medical Informatics, 83(11), 825-840.

Amatya, B., Galea, M., Kesselring, J., & Khan, F. (2015). Effectiveness of telerehabilitation interventions in persons with multiple sclerosis: A systematic review. Multiple Sclerosis and Related Disorders, 4, 370-375.

Ambrosino, N., Vitacca, M., Dreher, M., Isetta, V., & al., e. (2016). Tele-monitoring of ventilator-dependent patients: a European Respiratory Society Statement. European respiratory Journal.

Ammenwerth, E. (2019). Technology Acceptance Models in Health Informatics: TAM and UTAUT. Studies in Health Technology and Informatics, 263.

Anderson V., Johnson L. (1997) Systems thinking basics. From concepts to causal loops. Pegasus communication Inc., Cambridge, Massachusetts.

Anderson, K., Burford, O., & Emmerton, L. (2016). Mobile Health Apps to Facilitate Self-Care: A Qualitative Study of User Experiences. PLOS ONE.

Aquino, R. (2018). Envisioning smart and sustainable healthcare: 3D Printing technologies for personalized medication. Futures, 103, 35-50.

Aquino, R. P., Caputo, F., Corrente, M.I., Grasso, A., Saviano, M. (2018). Salute, farmaci e integratori in una visione sistemica: vigilanza su prodotti a base di isoflavoni di soia. Rapporto di ricerca. SYSTEMS MANAGEMENT, Giappichelli.

Aquino, R.P., Barile, S., Grasso, A., Saviano, M. (2018). Envisioning smart and sustainable healthcare: 3D Printing technologies for personalized medication. Futures, 103, 35-50

Arcury, T., Sandberg, J., Melius, K., Quandt, S., Leng, X., Latulipe, C., . . . Bertoni, A. (2018). Older Adult Internet Use and eHealth Literacy. 39(2).

Armocida, B., Formenti, B., Ussai, S., Palestra, F., Missoni, E. (2020). The Italian health system and the COVID-19 challenge. The Lancet.

Arfi, W., Nasr, I., Kondrateva, G., & Hikkerova, L. (2021). The role of trust in intention to use the IoT in eHealth: Application of the modified UTAUT in a consumer context. Technological Forecasting and Social Change, 167.

Asadi, S., Abdullah, R., Safaei, M., & Shah, N. (2019). Wearable Technology and Mobile Applications for Healthcare. Mobile Information Systems.

A zjen, I., & Fishbein, M. (1980). Understanding attitudes and predicting social behavior. Prentice-Hall, Englewood Cliffs, N.J.

A zjen, I. (2002). Constructing a TpB Questionnaire: Conceptual and Methodological Considerations.

Badr, H. S., & Gardner, L. M. (2021). Limitations of using mobile phone data to model COVID-19 transmission in the USA. Lancet Infect Dis., 21(5).

Ballantyne, D., & Nilsson, E. (2017). All that is solid melts into air: the servicescape in digital service-space. Journal of Service Marketing.

Barile, S. (2006). L' impresa come sistema. Contributi sull'approccio sistemico vitale (ASV). Giappichelli.

Barile, S., & Saviano, M. (2008). Le basi del pensiero sistemico: la dicotomia struttura-sistema (Foundation of Systems Thinking: The Structure-System Dichotomy). Operation Strategy eJournal.

Barile S. (2009) Management sistemico vitale. Torino, Giappichelli.

Barile, S. (2009). “The dynamic of informative varieties in the processes of decision making”. Proceedings of the 13th World Multi-Conference on Systemics, Cybernetics and Informatics: WMSCI, Florida, Florida.

Barile, S., & Polese, F. (2010). Linking the viable system and many-to-many network approaches to service-dominant logic and service science. International Journal of Quality and Service Sciences, 2(1).

Barile, S., & Saviano, M. (2010). A new perspective of systems complexity in service science. Impresa, Ambiente, Management, 4(3), 375-414.

Barile, S., Spohrer, J., & Polese, F. (2010). Editorial column—System thinking for service research advances, in Service Science

Barile, S. and Saviano, M (2011) Foundations of Systems Thinking: The Structure-System Paradigm (2011). in Various Authors, Contributions to Theoretical and Practical Advances in Management. A Viable Systems Approach (VSA). ASVSA, Associazione per la Ricerca sui Sistemi Vitali. International Printing, pp. 1-24, Available at SSRN: https://ssrn.com/abstract=2044579

Barile, S. and Polese, F. (2011), The Viable Systems Approach and Its Potential Contribution to Marketing Theory. Contributions to Theoretical and Practical Advances in Management: A Viable System Approach, p. 139.

Barile, S. (2012). Introduzione. In Condizioni di Efficacia Relazionale e di Performance Nell'Azienda Sanitaria; Saviano, M. Giappichelli.

Barile, S., Eletti, V., & Matteuzzi, M. (2013). Decisioni e scelte in contesti complessi. CEDAM.

Barile, S., Saviano, M., & Renzi, A. (2014). Paradigmi dominanti nel processo di aziendalizzazione della sanità. Un'interpretazione sistemica della responsabilità dell'azienda sanitaria. La Responsabilità in Ambito Sanitario. In Aleo, S., De Matteis, R., & Vecchio, G. (eds.). (2014). Le responsabilità in ambito sanitario (pp. 1-34). Cedam, Padova.

Barile, S., Saviano, M. & Polese, F. (2014). Information asymmetry and co-creation in health care services, Australasian Marketing Journal (AMJ), 22(3), pp. 205-217, ISSN 1441-3582, https://doi.org/10.1016/j.ausmj.2014.08.008.

Barile, S., Fulco, I., Loia, F., & Vito, P. (2018). Approccio sistemico vitale e aspect based sentiment analysis per il governo del territorio (Viable Systems Approach and aspect based sentiment analysis for governing the territory). Sinergie. Italian Journal of Management.

Barile, S., Grimaldi, M., Loia, F. (2020). Technology, Value Co-Creation and Innovation in Service Ecosystems: Toward Sustainable Co-Innovation. Sustainability.

Barile S., Saviano M. (2021) Interdisciplinary Systems Thinking for a New Scientific Paradigm: Toward a Re-founding of Human Values. In: Minati G. (eds) Multiplicity and Interdisciplinarity. Contemporary Systems Thinking. Springer, Cham. https://doi.org/10.1007/978-3-030-71877-0_3

Barile, S., Bassano, C., Piciocchi, P., Saviano, M. & Spohrer, J.C. (2021). Empowering value co-creation in the digital age. Journal of Business & Industrial Marketing.

Barile, S., Simone, C., Iandolo, F. & Laudando, A. (2022). Platform-based innovation ecosystems: Entering new markets through holographic strategies. Industrial Marketing Management, 105(4), pp. 467-477.

Barker, D., Schaik, D., & Corbett, W. (2003). Evaluating a spoken dialogue system for recording clinical observations during an endoscopic examination. Medical informatics and the Internet in medicine, 28(2), 85-97.

Bauer, K. (2000). The ethical and social dimensions of home-based telemedicine. Critical reviews in biomedical engineering, 28(3-4), 541-544.

Beer, S. (1972). Brain of the Firm. The Penguin Press.

Begum, M., Huq, R., Wang, R., & Mihailidis, A. (2015). Collaboration of an assistive robot and older adults with dementia. Gerontechnology, 13(4), 405-419.

Bergeson, S. C., & Dean, J. D. (2006). A systems approach to patient-centered care. JAMA, 296(23), 2848-2851.

Bhaskar, S., Bradley, S., Chattu, V., Adisesh, A., Nurtazina, A., Kyrykbayeva, S., . . . Ray, D. (2020). Telemedicine as the New Outpatient Clinic Gone Digital: Position Paper From the Pandemic Health System REsilience PROGRAM (REPROGRAM)

Bhattacherjee, A., & Hikmet, N. (2007). Physicians' resistance toward healthcare information technology: a theoretical model and empirical test. European Journal of Information Systems, 16(6), 725-737.

Binkin, N., Michieletto, F., Salmaso, S., & Russo, F. (2020). Protecting our health care workers while protecting our communities during the COVID-19 pandemic: a comparison of approaches and early outcomes in two Italian regions, 2020. MedRxiv. Retrieved from https://www.medrxiv.org/content/10.1101/2020.04.10.20060707v2

Block, V., Pitsch, E., Tahir, P., Cree, B., Allen, D., & Gelfand, J. (2016). Remote Physical Activity Monitoring in Neurological Disease: A Systematic Review. PLOS ONE, 11(4).

Bolton, R., McColl-Kennedy, J., Cheung, L., Gallan, A., Orsingher, C., Witell, L., & Zaki, M. (2018). Customer experience challenges: bringing together digital, physical and social realms. Journal of Service Management, 29(5), 775-808.

Bos, J. T., Frijters, D. H., Wagner, C., & et al. (2007). Variations in quality of Home Care between sites across Europe, as measured by Home Care Quality Indicators. Aging Clinical and Experimental Research, 19, 323-329.

Bourne, S., DeVos, R., North, M., & al., e. (2017). Online versus face-to-face pulmonary rehabilitation for patients with chronic obstructive pulmonary disease: randomised controlled trial. BMJ Open, 7.

Bowyer, S. A., Davies, B. L., & Rodriguez y Baena, F. (s.d.). Active Constraints/Virtual Fixtures: A Survey. IEEE Transactions on Robotics, 30(1), 138-157.

Braithwaite, J. (2018). Changing how we think about healthcare improvement. Quality improvement.

Brennan, D., Mawson, S., & Brownsell, S. (2009). Telerehabilitation: enabling the remote delivery of healthcare, rehabilitation, and self management. Studies in health technology and informatics, 145, 231–248.

Brennan, D., Tindall, L., Theodoros, D., & al., e. (2010). A blueprint for telerehabilitation guidelines. International Journal of Telerehabilitation, 2, 31-34.

Burches, E., & Burches, M. (2020). Efficacy, Effectiveness and Efficiency in the Health Care: The Need for an Agreement to Clarify its Meaning. Public Health and Community Medicine.

Cajita, M., Hodgson, N., Budhathoki, C., & Han, H. (2017). Intention to Use mHealth in Older Adults With Heart Failure. Journal of Cardiovascular Nursing, 32(6), E1-E7.

Cajita, M., Hodgson, N., Lam, K., Yoo, S., & Han, H. (2018). Facilitators of and Barriers to mHealth Adoption in Older Adults With Heart Failure. Computers, informatics, Nursing, 36(8), 376-382.

Caputo, F. (2018). Approccio sistemico e co-creazione di valore in sanità. Edizioni Nuova Cultura, Roma.

Caputo, F., Masucci, A., Napoli, L. (2018). Managing value co-creation in pharmacy. International Journal of Pharmaceutical and Healthcare Marketing

Caputo, F. Garcia-Perez, A., Cillo, V., Giacosa, E. (2019). A knowledge-based view of people and technology: directions for a value co-creation-based learning organization. Journal of Knowledge.

CERGAS. (2019). La Struttura e le attività del SSN. In Rapporto OASI 2019. CERGAS Bocconi.

Cepiku, D., Giordano, F., Bovaird, T., & Loffler, E. (2021). New development: Managing the Covid-19 pandemic—from a hospital-centred model of care to a community co-production approach. Public Money and Management, 41(1), 77-80.

Charani, E., Castro-Sànchez, E., Moore, L. S., & Holmes, A. (2014). Do smartphone applications in healthcare require a governance and legal framework? It depends on the application! BMC Medicine, 12(29).

Charvet, L., Yang, J., Shaw, M., Sherman, K., Haider, L., Xu, J., & Krupp, L. (2017). Cognitive function in multiple sclerosis improves with telerehabilitation: Results from a randomized controlled trial. PLOS ONE, 13(1).

Chau, P., & Hu, P. (2002). Examining a Model of Information Technology Acceptance by Individual Professionals: An Exploratory Study. Journal of Management information systems, 18(4), 191-229.

Chen, C., Wu, J., & Grandall, R. (2007). Obstacles to the adoption of radio frequency identification technology in the emergency rooms of hospitals. International Journal of Electronic Healthcare, 3(2), 193-207.

Chen, J., Jin, W., Zhang, X., Xu, W., Liu, X., & Ren, C. (2015). Telerehabilitation Approaches for Stroke Patients: Systematic Review and Meta-analysis of Randomized Controlled Trials. Journal of Stroke & Cardiovascular Diseases, 24(12), 2660-2668.

Chen, J., Jin, W., Dong, W., Jin, Y., Qiao, F., Zhou, Y., & Ren, C. (2017). Effects of Home-based Telesupervising Rehabilitation on Physical Function for Stroke Survivors with Hemiplegia A Randomized Controlled Trial. American Journal of Physical Medicine & Rehabilitation, 96(3), 152-160.

Chirra, M., Marsili, L., Wattley, L., Sokol, L., Keeling, E., Maule, S., . . . Merola, A. (2019). Telemedicine in Neurological Disorders: Opportunities and Challenges. Telemedicine and e-Health, 25(7).

Chen, Y., Abel, K., Janecek, J., Chen, Y., Zheng, K., & Cramer, S. (2019). Home-based technologies for stroke rehabilitation: A systematic review. International Journal of Medical Informatics, 123, 11-22.

Chismar, W., & Wiley-Patton, S. (2002). Test of the technology acceptance model for the internet in pediatrics. Proceedings of the AMIA Symposium (p. 155). American medical informatics Association.

Chumbler, N. R., Quigley, P., Li, X., Morey, M., Rose, D., Sanford, J., . . . Hoenig, H. (2012). Effects of Telerehabilitation on Physical Function and Disability for Stroke Patients. A Randomized, Controlled Trial. Stroke, 43(8), 2168–2174.

Ciasullo, M. V., Lim, W. M., Manesh, M. F., & Palumbo, R. (2022). The patient as a prosumer of healthcare: insights from a bibliometric-interpretive review. Journal of Health Organization and Management.

Ciasullo, M. V., Orciuoli, F., Douglas, A., & Palumbo, R. (2022). Putting Health 4.0 at the service of Society 5.0: Exploratory insights from a pilot study. Socio-Economic Planning Sciences, 80, 101163.

Comperman, M., Brenčič, M., & Trkam, P. (2016). Analyzing older users' home telehealth services acceptance behavior—applying an Extended UTAUT model. International Journal of Medical Informatics, 90, 22-31.

Cook, E., Randhawa, G., Sharp, C., Ali, N., Guppy, A., Barton, G., . . . Crawford-White, J. (2016). Exploring the factors that influence the decision to adopt and engage with an integrated assistive telehealth and telecare service in Cambridgeshire, UK: a nested qualitative study of patient 'users' and 'non-users'. BMC Health Services Research, 16.

Cottrell, M., Galea, O., O'Leary, S., Hill, A., & Russell, T. (2016). Real-time telerehabilitation for the treatment of musculoskeletal conditions is effective and comparable to standard practice: a systematic review and meta-analysis. Clinical Rehabilitation, 31(5).

Cottrell, M., & Russell, T. (2020). Telehealth for musculoskeletal physiotherapy. Musculoskeletal Science and Practice.

Cox, N., McDonald, C., Hill, C., O'Halloran, P., Alison, J., Zanaboni, P., . . . Holland, A. (2018). Telerehabilitation for chronic respiratory disease. Cochrane Database of Systematic Reviews.

Cramer, S., Dodakian, L., Le, V., & al., e. (2019). Efficacy of Home-Based Telerehabilitation vs In-Clinic Therapy for Adults After Stroke. A Randomized Clinical Trial. JAMA Neurology, 76(9), 1079-1087.

Crowe, S., Cresswell, K., Robertson, A., Huby, G., Avery, A. & Sheik, A. (2011). The case study approach. BMC Medical Research Methodology, 11:100.

De Cola, M., Maresca, G., D'Aleo, G., Carnazza, L., Giliberto, S., Maggio, M., . . . Calabrò, R. (2020). Teleassistance for frail elderly people: A usability and customer satisfaction study. Geriatric Nursing, 41(4), 463-467.

De Keyser, A., Lemon, K., Klaus, P., & Keiningham, T. (2015). A framework for understanding and managing the customer experience. Working Paper Series No. 15-121.

DeFre Galea, M. (2019). Telemedicine in Rehabilitation. Physical Medicine and Rehabilitation Clinics of North America, 30(2), 473-483.

Department for Business Energy and Industrial Strategy. (2017). Industrial Strategy: Building a Britain Fit for the Future.

de Veer, A., Peeters, J., Brabers, A., Schellevis, F., Rademakers, J., & Francke, A. (2015). Determinants of the intention to use e-Health by community dwelling older people. BMC Health Services Research, 15.

Dhagarra, D., Goswami, M., & Kumar, G. (2020). Impact of Trust and Privacy Concerns on Technology Acceptance in Healthcare: An Indian Perspective. International Journal of Medical Informatics, 141.

Dhiliwal, S. R., & Salins, N. (2015). Smartphone Applications in Palliative Homecare. Indian J Palliat Care, 21(1), 88-91.

Ding, X., Clifton, D., Ji, N., Lovell, N., Bonato, P., & Chen, W. (2021). Wearable Sensing and Telehealth Technology with Potential Applications in the Coronavirus Pandemic. IEEE Reviews in Biomedical Engineering, 14, 48-70.

Dobkin, B. (2016). A Rehabilitation-Internet-of-Things in the Home to Augment Motor Skills and Exercise Training. Neurorehabilitation and Neural Repair, 31(3).

Dodakian, L., McKenzie, A., Le, V., See, J., Pearson-Fuhrhop, K., Quinlan, E., . . . Cramer, S. (2017). A Home-Based Telerehabilitation Program for Patients With Stroke. Neurorehabilitation and Neural Repair, 31(10-11).

Dou, K., Yu, P., Deng, N., Liu, F., Guan, Y., Li, Z., . . . Duan, H. (2017). Patients' Acceptance of Smartphone Health Technology for Chronic Disease Management: A Theoretical Model and Empirical Test. JMIR nHealth and uHealth, 5(12).

Dozois, D. J., Mikail, S. F., Alden, L. E., Bieling, P. J., Bourgon, G., Clark, D. A., . . . Hunsley, J. (2014). The CPA Presidential Task Force on Evidence-Based Practice of Psychological Treatments. Canadian Psychology, 55(3), 153-160.

Duyck, P., Pynoo, B., Devolder, P., Voet, T., Adang, L., & Vercruysse, J. (2008). User acceptance of a picture archiving and communication system. Applying the unified theory of acceptance and use of technology in a radiological setting. Methods of Information in medicine, 47(02), 149-156.

Dwivedi, Y., Shareef, M., Simintiras, A., Lal, B., & Weerakkody, V. (2016). A generalised adoption model for services: A cross-country comparison of mobile health (m-health). Government Information Quarterly, 33(1), 174-187.

Edgren, L. (2006). Health consumer diversity and its implications. Journal of Systems Science and Systems Engineering, 15(1), 34-47.

Edwards, L., Thomas, C., gregory, A., yardley, L., O'cathain, A., Montgomery, A., & Salisbury, C. (2014). Are People With Chronic Diseases Interested in Using Telehealth? A Cross-Sectional Postal Survey. Journal of Medical Internet research, 16(5).

Elrod, J. K., & Fortenberry, J. L. (2017). The hub-and-spoke organization design revisited: a lifeline for rural hospitals. BMC Health Service Research.

Enaizan, O., Zaidan, A., Alwi, N., Zaidan, B., Alsalem, M., Albahri, O., & Albahri, A. (2020). Electronic medical record systems: decision support examination framework for individual, security and privacy concerns using multi-perspective analysis. Health and Technology, 10, 795-822.

Espejo, R., & Gill, A. (1997). The viable system model as a framework for understanding organizations. Phrontis Limited & SYNCHO Limited.

Estae, E. S., Mays, M. H., Harrigan, R., & Mayberry, R. (2014). Incorporating translational research with clinical research to increase effectiveness in healthcare for better health. Clinical and Translational Medicine, 3(20).

Fan, W., Liu, J., Zhu, S., & Pardalos, P. (2020). Investigating the impacting factors for the healthcare professionals to adopt artificial intelligence-based medical diagnosis support system (AIMDSS). Annals of Operations Research, 294, 567-592.

Fejit, M., de Kort, Y., Bongers, I., & Jsselsteijn, W. (2018). Perceived Drivers and Barriers to the Adoption of eMental Health by Psychologists: The Construction of the Levels of Adoption of eMental Health Model. Journal of Medical internet Research, 20(4).

Fiano, F., Sorrentino, M., Caputo, F., Smarra, M. (2022). Intellectual capital for recovering patient centrality and ensuring patient satisfaction in healthcare sector. Journal of intelectual capital.

France, G., Taroni, F, & Donatini, A. (2005). The Italian Health-care System. Health economics. 14. S187-202. 10.1002/hec.1035.

France, G., Taroni, F. & Donatini, A. (2019). The Italian health-care system.

Ford, E. S., Croft, J. B., Posner, S. F., Goodman, R. A., & Giles, W. H. (2013). Co-Occurrence of Leading Lifestyle-Related Chronic Conditions Among Adults in the United States, 2002-2009. Prev Chronic Dis, 10.

Frederix, I., Hansen, D., Coninx, K., Vandervoort, P., Van Craenenbroeck, E. M., Vrints, C., & Dendale, P. (2015). Telerehab III: a multi-center randomized, controlled trial

investigating the long-term effectiveness of a comprehensive cardiac telerehabilitation program - Rationale and study design. BMC Cardiovascular Disorders, 15(19).

Frederix, I., Hansen, D., Coninx, K., Vandervoort, P., Vadijck, D., Hens, N., . . . Dendale, P. (2015). Medium-Term Effectiveness of a Comprehensive Internet-Based and Patient-Specific Telerehabilitation Program With Text Messaging Support for Cardiac Patients: Randomized Controlled Trial. Journal of medicine Internet Research, 17(7).

Gagnon, M., Ghandour, E., Talla, P., Simonya, D., Godin, G., Labrecque, M., . . . Rousseau, M. (2014). Electronic health record acceptance by physicians: Testing an integrated theoretical model. Journal of Biomedical Informatics, 48, 17-27.

Galiano-Gastillo, N., Cantarero-Villanueva, I., Fernández-Lao, C., Ariza-García, A., Díaz-Rodríguez, L., Del-Moral-Ávila, R., & Arroyo-Morales, M. (2016). Telehealth system: A randomized controlled trial evaluating the impact of an internet-based exercise intervention on quality of life, pain, muscle strength, and fatigue in breast cancer survivors. American Cancer Society Journals, 122(20), 3166-3174.

Gandolfi, M., Geroin, C., Dimitrova, E., Boldrini, P., Walder, A., Bonadiman, S., . . . Gravina, R. (2017). Virtual Reality Telerehabilitation for Postural Instability in Parkinson's Disease: A Multicenter, Single-Blind, Randomized, Controlled Trial. BioMed Research International.

Gao, Y., Li, H., & Luo, Y. (2015). An empirical study of wearable technology acceptance in healthcare. Industrial Management & Data Systems, 115(9).

Genet, N., Boerma, W. G., Kringos, D. S., Bouman, A., Francke, A. L., Fagerstrom, C., . . . Devillé, W. (2011). Home care in Europe: a systematic literature review. BMC Health Services Research, 11(207).

Geronimo, A., Wright, C., Morris, A., Walsh, S., Snyder, B., & Simmons, Z. (2017). Incorporation of telehealth into a multidisciplinary ALS Clinic: feasibility and acceptability. Amyotrophic Lateral Sclerosis and Frontotemporal Degeneration, 18(7-8), 555-561.

Golant, S. (2017). A theoretical model to explain the smart technology adoption behaviors of elder consumers (Elderadopt). Journal of Aging Studies, 42, 56-73.

Golinelli G.M. (2000) L'approccio sistemico al governo dell'impresa. Vol I. CEDAM, Padova.

Golinelli G.M. (2005) L'approccio sistemico al governo dell'impresa. Vol I. (Second edition), CEDAM, Padova.

Golinelli, G. M. (2010). Viable Systems Approach (VSA). Governing Business Dynamics. Kluwer, CEDAM.

Gopura, R., Bandara, D., Kiguchi, K. & Mann, G. (2016). Developments in hardware systems of active upper-limb exoskeleton robots: A review. Robotics and Autonomous Systems, 75(Part B), 203-220.

Greenhalhg, T., & Papoutsi, C. (2018). Studying complexity in health services research: desperately seeking an overdue paradigm shift. BCM Med, 16(95).

Greenhalgh, T., Procter, R., Wherton, J., Sugarhood, P., Hinder, S., & Rouncefield, M. (2015). What is quality in assisted living technology? The ARCHIE framework for effective telehealth and telecare services. BCM Medicine, 13.

Grob, R. (2013). The heart of patient-centered care. Journal of Health Politics, Policy and Law, 38(2), 457-465.

Guo, X., Zhang, X., & Sun, Y. (2016). The privacy–personalization paradox in mHealth services acceptance of different age groups. Electronic Commerce Research and Applications, 16, 55-65.

Guverich, P., Lanir, J., & Cohen, B. (2015). Design and Implementation of TeleAdvisor: a Projection-Based Augmented Reality System for Remote Collaboration. Computer Supported Cooperative Work, 24, 527-562.

Haas, H., Andreassen, H., Lien, L., Hjalmarsen, A., & Zanaboni, P. (2016). Adherence and factors affecting satisfaction in long-term telerehabilitation for patients with chronic obstructive pulmonary disease: a mixed methods study. BMC Medical Informatics and Decision Making, 16(26).

Hallo, L., Gorod, A., & Merchant, S. (2021). The evolution of healthcare towards patient-centred care and the need for systemic approaches. Systems Research and Behavioral Science, 38(2), 191-196.

Han, S., Mustonen, P., Seppänen, M., & Kallio, M. (2005). Does Fragmentation of Working Time and Working Space Influence the Acceptance of Mobile Technology? A Case of Finnish Physicians. Turku Ventre for Computer Science.

Hannemann, S., Beutel, M., & Zwerenz, R. (2017). Ready for eHealth? Health Professionals' Acceptance and Adoption of eHealth Interventions in Inpatient Routine Care. Journal of Health Communication, 22(3), 274-284.

Hannes, J., Kieselbach, F., Kladtke, R., Wirsching, K., & Zucchinali, R. (2015). A Cross Comparative Analysis of the U.S., German, and Italian Healthcare System. Globalization and Public Policy, 93-119.

Hilty, D., & al., e. (2013). The effectiveness of telemental health: a 2013 review. Telemedicine Journal and e-health, 19(6), 444-454.

Hoogenbosch, B., Postma, J., de Man-van Ginkel, J., Tiemessen, N., van Delden, J., & van Os-Medendorp, H. (2018). Use and the Users of a Patient Portal: Cross-Sectional Study. Journal of Medical internet research, 20(9).

Hoque, R. (2016). An empirical study of mHealth adoption in a developing country: the moderating effect of gender concern. BMC Medical Informatics and Decision Making, 16.

Hoque, R., & Sorwar, G. (2017). Understanding factors influencing the adoption of mHealth by the elderly: An extension of the UTAUT model. International Journal of Medical Informatics, 101, 75-84.

Holder, R., & Karsh, B. (2010). The technology acceptance model: its past and its future in health care. Journal of Biomedical Informatics, 43(1), 159-172.

Horak, F., King, L., & Mancini, M. (2015). Role of Body-Worn Movement Monitor Technology for Balance and Gait Rehabilitation. Physical Therapy, 95(3), 461-470.

Hornby, T., Holleran, C., Hennessy, P., Leddy, A., Connolly, M., Camardo, J., . . . Roth, E. (2015). Variable Intensive Early Walking Poststroke (VIEWS): A Randomized Controlled Trial. Neurorehabilitation and Neural Repair, 30(5).

Hossain, A., Quaresma, R., & Rahman, H. (2019). Investigating factors influencing the physicians' adoption of electronic health record (EHR) in healthcare system of Bangladesh: An empirical study. International Journal of Information Management, 44, 76-87.

Howard, I., & Kaufman, M. (2018). Telehealth applications for outpatients with neuromuscular or musculoskeletal disorders. Muscle & Nerve, 58(4), 475-485.

Hsieh, P. (2015). Healthcare professionals' use of health clouds: Integrating technology acceptance and status quo bias perspectives. International Journal of Medical Informatics, 84(7), 512-523.

Hu, P., Chau, P., Sheng, O., & Tam, K. (1999). Examining the Technology Acceptance Model Using Physician Acceptance of Telemedicine Technology. Journal of Management Information Systems, 16(2), 91-112.

Hwang, R., Bruning, J., Morris, N., Mandrusiak, A., & Russell, T. (2017). Home-based telerehabilitation is not inferior to a centre-based program in patients with chronic heart failure: a randomised trial. Journal of Physiotherapy, 63(2), 101-107.

Iandolo, F. and Calabrese, M. and Antonucci, E. and Caputo, F. (2013). Towards a Value Co-Creation Based Healthcare System. Gummesson, E., Mele, C., Polese, F.(eds.), The 2013 Naples Forum on Service. Service Dominant Logic, Networks & Systems Theory and Service Science: Integrating three Perspective for a new Service Agenda, p. 61, 2013, Available at SSRN: https://ssrn.com/abstract=2342260

Iandolo, F., Vito, P., Fulco, I. & Loia, F. (2018). From Health Technology Assessment to Health Technology Sustainability. Sustainability, 10, 4748. https://doi.org/10.3390/su10124748

Iandolo, F. & Cosimato, S. (2019). Shaping Sustainable Service Ecosystems: An Analysis of Some Possible Enhancing Factors. pIJ : puntOorg international journal, pp. 2499-1333. http://digital.casalini.it/10.19245/25.05.pij.4.2.3

IfM & IBM (2008). Value Co-Creation by Customer-to-Customer Communication: Social Media and Face-to-Face for Case of Airline Service Selection. University of Cambridge Institute for Manufacturing.

Institute of Medicine (2001). Crossing the quality chasm: A new health system for the 21st century. National Academy Press.

International Consortium (Part 2). Frontiers in Public Health, 8.

Javdani, S., Admoni, H., Pellegrinelli, S., Srinivasa, S. S., & Bagnell, J. (2018). Shared autonomy via hindsight optimization for teleoperation and teaming. The International journal of Robotics Research, 37(7).

Jesus, T., Landry, M., Dussault, G., & Fronteira, I. (2017). Human resources for health (and rehabilitation): Six Rehab-Workforce Challenges for the century. Human Resources for Health, 15.

Jiang, S., Xiang, J., Gao, X., Guo, K., & Liu, B. (2016). The comparison of telerehabilitation and face-to-face rehabilitation after total knee arthroplasty: A systematic review and meta-analysis. Journal of Telemedicine and Telecare, 24(4).

Joiner, K., & Lusch, R. (2016). Evolving to a new service-dominant logic for health care. Innovation and Entrepreneurship in Health, 25.

Kairy, D., Lehoux, P., Vincent, C., & Visintin, M. (2009). A systematic review of clinical outcomes, clinical process, healthcare utilization and costs associated with telerehabilitation. Disability and Rehabilitation, 31(6), 427-447.

Kamal, S., Shafid, M., & Kakria, P. (2020). Investigating acceptance of telemedicine services through an extended technology acceptance model (TAM). Technology in Society, 60.

Karahoca, A., Karahoca, D., & Aksöz, M. (2017). Examining intention to adopt to internet of things in healthcare technology products. Kybernetes, 47(4).

Katzan, H. (2008). Foundations Of Service Science Concepts And Facilities. Journal of Service Science, 1(1).

Keck, C., & Doarn, C. (2014). Telehealth Technology Applications in Speech-Language Pathology. Telemedicine and e-Health, 20(7).

Kessler, M.M. (1963). Bibliographic coupling between scientific papers. American Documentation, 14(1), pp. 10-25.

Khan, F., Amatya, B., Galea, M., Gonzenbach, R., & Kesselring, J. (2017). Neurorehabilitation: applied neuroplasticity. Neurological Update, 264(603-615).

Khosla, R., Nguyen, K., & Chu, M. (2017). Human Robot Engagement and Acceptability in Residential Aged Care. International Journal of Human–Computer Interaction, 33(6), 510-522.

Koceski, S., & Koceska, N. (2016). Evaluation of an Assistive Telepresence Robot for Elderly Healthcare. Journal of Medical Systems, 40.

Kongstvedt, P. R. (2001). The Managed Health Care Handbook (4th edition ed.). Aspen publication.

Kohnke, A., Cole, M., & Bush, R. (2014). Incorporating UTAUT Predictors for Understanding Home Care Patients' and Clinician's Acceptance of Healthcare Telemedicine Equipment. Journal of Technology Management & Innovation, 9(2).

Kowitlawakul, Y., Wai, S., Pulcini, J., & Wang, W. (2015). Factors influencing nursing students' acceptance of electronic health records for nursing education (EHRNE) software program. Nurse Education Today, 35(1), 189-194.

Kumar, V., & Reinartz, W. (2016). Creating Enduring Customer Value. Journal of Marketing, 80(6), 36-68.

Kupra, A., Folio, D., Novales, C., Vieyres, P., & Li, T. (2014). Robotized Tele-Echography: An Assisting Visibility Tool to Support Expert Diagnostic. IEEE Systems Journal, 10(3), 974 - 983.

Lamberti, F., Manuri, F., Sanna, A., Paravanti, G., Pezzolla, P., & Montuschi, P. (2014). Challenges, Opportunities, and Future Trends of Emerging Techniques for Augmented Reality-Based Maintenance. IEEE Transactions on Emerging Topics in Computing, 2(4), 411-421.

Laniel, S., Létourneau, D., Labbé, M., Grondin, F., Polgar, J., & Michaud, F. (2017). Adding navigation, artificial audition and vital sign monitoring capabilities to a telepresence

mobile robot for remote home care applications. 2017 International Conference on Rehabilitation Robotics (ICORR), (p. 809-811). London, UK.

Langhorne, P., Bernhardt, J., & Kwakkel, G. (2011). Stroke rehabilitation. The Lancet, 377, 1693-1702.

Larson, E., Feigon, M., Gagliardo, P., & Dvorkin, A. (2014). Virtual Reality and Cognitive Rehabilitation: A Review of Current Outcome Research'. NeutoRehabilitation, 34(4), 759-772.

Laver, K. E., Lange, B., George, S., Deutsch, J. E., Saposnik, G., Crotty, M., & Cochrane Stroke Group. (2017). Virtual reality for stroke rehabilitation. Cochrane Database Systematic Review, 11.

Le Bihan, B., & Martin, C. (2006). A Comparative Case Study of Care Systems for Frail Elderly People: Germany, Spain, France, Italy, United Kingdom and Sweden. Social and Policy Administration.

Leeflang, P., Verhoef, P., Dahlström, P., & Freundt, T. (2014). Challenges and solutions for marketing in a digital era. European Management Journal, 32(1).

Lemon, K., & Verhoef, P. (2016). Understanding customer experience throughout the customer journey. Journal of Marketing, 80(6), 69-96.

Li, J., Ma, Q., Chan, A., & Man, S. (2019). Health monitoring through wearable technologies for older adults: Smart wearables acceptance model. Applied Ergonomics, 75, 162-169.

Li, Z., yang, C., & Burdet, E. (2016). Guest Editorial An Overview of Biomedical Robotics and Bio-Mechatronics Systems and Applications. IEEE Transactions on Systems, Man, and Cybernetics: Systems, 46(7), 869-874.

Li, Z., Moran, P., Dong, Q., Shaw, R. J., & Hauser, K. (2017). Development of a tele-nursing mobile manipulator for remote care-giving in quarantine areas. IEEE International Conference on Robotics and Automation (ICRA), (p. 3581-3586). Singapore.

Liang, H., Xue, Y., & Byrd, T. (2003). PDA usage in healthcare professionals: Testing an extended technology acceptance model. International Journal of Mobile Communication, 1(4), 327-389.

Liu, L., & Ma, Q. (2006). Perceived system performance: a test of an extended technology acceptance model. Advances in information Systems, 37(2-3), 51-59.

Lloréns, R., Noé, E., Colomer, C., & Alcañiz, M. (2014). Effectiveness, Usability, and Cost-Benefit of a Virtual Reality–Based Telerehabilitation Program for Balance Recovery

After Stroke: A Randomized Controlled Trial. Archives of Physical Medicine and Rehabilitation, 96(3), 418-425.

Loncar-Turukalo, T., Zdravevski, E., Machado da Silva, J., Chouvarda, I., & Trajkovik, V. (2019). Literature on Wearable Technology for Connected Health: Scoping Review of Research Trends, Advances, and Barriers. Journal of Medical Internet Research, 21(9).

Longo, F., & Ricci, A. (2019). Ridefinire la missione del SSN nell'universo sanitario in espansione: prospettive strategiche per promuovere l'innovazione. In Rapporto OASI 2019. Bocconi, Cergas.

Low, L.F., Yap, M., & Brodaty, H. (2011). A systematic review of different models of home and community care services for older persons. BMC Health Serv Res, 11(93).Maris, D. (2014). US healthcare welcome to Italy. Forbes. Retrieved from http://www.forbes.com/sites/davidmaris/2012/11/07/us-healthcarewelcome-to-italy/

Lusch, R., & Vargo, S. (2006). Service-Dominant Logic: Reactions, Reflections and Refinements. Marketing Theory, 6(3).

Lusch, R. F., & Vargo, S. L. (2014). Cambridge University Press.

Maddison, R., Rawstorn, J., Stewart, R., Benatar, J., Whittaker, R., Rolleston, A., . . . Gant, N. (2019). Effects and costs of real-time cardiac telerehabilitation: randomised controlled non-inferiority trial. Heart, 105, 122-129.

Maglio, P. P., Vargo, S. L., Caswell, N., & Spohrer, J. (2009). The service system is the basic abstraction of service science. Inf Syst E-Bus Manage, 7, 395–406.

Magliocca, P., Calabrese, M. & Simone, C. (2016). Going Away From the "Protocol Culture": Innovation, Complexity and the Need for a Culture of Variety. China-USA Business Review, 15(4), pp. 194-204.

Mani, S., Sharma, S., Omar, B., Paungmali, A., & Joseph, L. (2016). Validity and reliability of Internet-based physiotherapy assessment for musculoskeletal disorders: a systematic review. Journal of Telemedicine and Telecare, 23(3).

Mantovani, E., Zucchella, C., Bottiroli, S., Federico, A., Giugno, R., Sandrini, G., . . . Tamburin, S. (2020). Telemedicine and Virtual Reality for Cognitive Rehabilitation: A Roadmap for the COVID-19 Pandemic. Frontiers in Neurology, 11.

Markle-Reid, M., McAiney, C., Fisher, K., Genann, R., Gauthier, A. P., Heald-Taylor, G., . . . Whitmore, C. (2021). Effectiveness of a nurse-led hospital-to-home transitional care intervention for older adults with multimorbidity and depressive symptoms: A pragmatic randomized controlled trial. PLoS One, 16(7).

Maris, D. (2014). US healthcare welcome to Italy. Forbes. Tratto da http://www.forbes.com/sites/davidmaris/2012/11/07/us-healthcarewelcome-to-italy/

Martini, G., Berta, P., Mullahy, J., & Vittadini, G. (2014). The Effectiveness-Efficiency Trade-Off in Health Care: The Case of Hospitals in Lombardy, Italy. Regional Science and Urban Economics, 49.

Marziniak, M., Brichetto, G., Feys, P., Meyding-Lamadé, U., Vernon, K., & Meuth, S. (2018). The Use of Digital and Remote Communication Technologies as a Tool for Multiple Sclerosis Management: Narrative Review. JMIR Rehabilitation and Assistive Technologies, 5(1).

Matamala-Gomez, M., Bottiroli, S., Realdon, O., Riva, G., Galvagni, L., Platz, T., . . . Tassorelli, C. (2021). Telemedicine and Virtual Reality at Time of COVID-19 Pandemic: An Overview for Future Perspectives in Neurorehabilitation. Frontiers in Neurology, 12.

McCann, S., Ryan, A. A., & McKenna, H. (2005). The challenges associated with providing community care for people with complex needs in rural areas: a qualitative investigation. Health Soc Care Community, 13(5), 462-469.

McColl-Kennedy, J., Vargo, S., Dagger, T., & Sweeney, J. (2009). Customers as resources integrators: styles of customer co-creation. The 2009 Forum on Services: Service-Dominant Logic, Service Science, and Network Theory.

McColl-Kennedy, J. R., Vargo, S. L., Danaher, T. S., Sweeney, J., & va Kasteren, Y. (2012). Health Care Customer Value Cocreation Practice Styles. Journal of Service Research, 15(4), 370-389.

McCue, M., Fairman, A., & Pramuka, M. (2010). Enhancing quality of life through telerehabilitation. Physical medicine and rehabilitation clinics of North America, 21(1), 195-205.

McLean, S., Nurmatov, U., Liu, J. L., Pagliari, C., Car, J., & Sheikh, A. (2012). Telehealthcare for chronic obstructive pulmonary disease: Cochrane Review and meta-analysis. The British journal of general practice : the journal of the Royal College of General Practitioners, 62(604), e739–e749.

Milani, R., Bober, R., & Lavie, C. (2016). The Role of Technology in Chronic Disease Care. Progress in Cardiovascular Diseases, 58(6), 579-583.

Miralles, F., Vargiu, E., Rafael-Palou, X., Solà, M., Dauwalder, S., Guger, C., . . . Daly, J. (2015). Brain–Computer Interfaces on Track to Home: Results of the Evaluation at Disabled End-Users' Homes and Lessons Learnt. Frontiers in ICT.

Monacelli, T., & Polo, M. (2020, April 03). Covid, cosa abbiamo imparato e cosa vorremmo sapere. Lavoce.info.

Muelling, K., Venkatraman, A., Valois, J., Downey, J., Weiss, J., Javdani, S., . . . Bagnell, J. (2017). Autonomy infused teleoperation with application to brain computer interface controlled manipulation. Autonomous Robots, 41, 1401-1422.

Mun, Y., Jackson, J., Park, J., & Probst, J. (2006). Understanding information technology acceptance by individual professionals: Toward an integrative view. Information & Management, 43(3), 350-363.

Nacoti, M., Ciocca, A., Giupponi, A., Brambillasca, P., & Lussana, F. (2020). At the Epicenter of the Covid-19 Pandemic and Humanitarian Crises in Italy: Changing Perspectives on Preparation and Mitigation. Innovations in Care Delivery. Retrieved from https://catalyst.nejm.org/doi/full/10.1056/CAT.20.0080

Najafi, M., Sharifi, M., Adams, K., & Tavakoli, M. (2017). Robotic assistance for children with cerebral palsy based on learning from tele-cooperative demonstration. International Journal of Intelligent Robotics and Applications, 1, 43-54.

Naughton, P., & Hauser, K. (2022). Structured Action Prediction for Teleoperation in Open Worlds. IEEE Robotics and Automation Letters, 7(2), 3099-3105.

Naylor, S., & Chen, J. Y. (2010). Unraveling human complexity and disease with systems biology and personalized medicine. Personalized Medicine, 7(3).

Nidumolu, R., Prahalad, C.K. and Rangaswami, M.R. 2009. Why sustainability is now the key driver for innovation. Harvard Business Review. September 57-64.

Nigro, C., Iannuzzi, E., Miriam, P., & Sonia, D. V. (2015). How Health Care Moves on the Web: The Case of Health Social Network. In 18° Toulon-Verona (ICQSS) International Conference, pp. 387-400.

OECD. (2015). Primary and community care in Italy. In OECD Reviews of health care quality: Italy 2014 (pp. 95-130).

op den Akker, H., Jones, V., & Hermens, H. (2014). Tailoring real-time physical activity coaching systems: a literature survey and model. User Modeling and User-Adapted Interaction, 24, 351-392.

Paci, P., & Wagstaff, A. (1993). Equity and efficiency in Italian health care. Health Economics, 2(1).

Padula, M. S., Ferrari, G., Demurtas, J., Rossi, F., Pellacani, G., Vanier, M.-C., & Ventriglia, G. (2016). Approccio alla cronicità: la partnership dei medici di medicina generale

con il paziente nella formazione di base dei professionisti della salute e nell'educazione terapeutica. Società Italiana di Medicina Generale, 4, 3-5.

Palazzo, C., Klinger, E., Dorner, V., Kadri, A., Thierry, O., Boumenir, Y., . . . Ville, I. (2016). Barriers to home-based exercise program adherence with chronic low back pain: Patient expectations regarding new technologies. Annals of Physical and Rehabilitation Medicine, 59(2), 107-113.

Palozzi, G., & Ranalli, F. (2023). Telemedicine Implementation Between Innovation and Sustainability: An Operating Model for Designing Patient-Centered Healthcare. Human-Centered Service Design for Healthcare Transformation, 375-399.

Paré, G., Sicotte, C., & Jacques, H. (2006). The effects of creating psychological ownership on physicians' acceptance of clinical information systems. Journal of the AmericanMedical informatics Association, 13(2), 197-205.

Pareek, S., Manjunath, H., Esfahani, E. T., & Kesavadas, T. (2019). MyoTrack: Realtime Estimation of Subject Participation in Robotic Rehabilitation Using sEMG and IMU. IEEE Access, 7, 76030-76041.

Parise, S., Guinan, P., & Kafka, R. (2016). Solving the crisis of immediacy: How digital technology can transform the customer experience. Business Horizons.

Parise, M., Tartaglione, L., Cutrozzolà, A., Maiorino, M., Esposito, K., Pitocco, D., . . . Irace, C. (2021). Teleassistance for patients with type 1 diabetes during the COVID-19 pandemic: Results of a pilot study. Journal of Medical Internet Research, 23(4).

Pastora-Bernal, J., Martín-Valero, R., Barón-López, F., & Estebanez-Pérez, M. (2017). Evidence of Benefit of Telerehabitation After Orthopedic Surgery: A Systematic Review. Journal of Medical Internet Research, 19(4).

Peek, S., Lujikx, K., Rijnaard, M., Nieboer, M., van der Voort, C., Aarts, S., . . . Wouters, E. (2016). Older Adults' Reasons for Using Technology while Aging in Place. Gerontology, 62, 226-237.

Pels, J., Barile, S., Saviano, M., Polese, F., Carrubbo, L. (2014). The contribution of VSA and SDL perspectives to strategic thinking in emerging economies. Managing Service Quality: An International Journal.

Pelliccia, L. (2019). Dove sta andando l'ADI? Le principali tendenze evolutive delle cure domiciliari. I luoghi della cura rivista online. Network Non Autosufficienza (NNA).

Pecoraro, F., Luzi, D., & Clemente, F. (2021). Analysis of the Different Approaches Adopted in the Italian Regions to Care for Patients Affected by COVID-19. Int. J. Environ. Res. Public Health, 18(3), 848.

Piepoli, M., Hoes, A., Agewall, S., Albus, C., Brotos, C., & al., e. (2016). 2016 European Guidelines on cardiovascular disease prevention in clinical practice: The Sixth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representati. European Heart Journal, 37(29), 2315-2381.

Piotrowicz, E., Zieliński, T., Bodalski, R., Rywik, T., Dobraszkiewicz-Wasilewska, B., Sobieszczańska-Małek, M., . . . Piotrowicz, R. (2015). Home-based telemonitored Nordic walking training is well accepted, safe, effective and has high adherence among heart failure patients, including those with cardiovascular implantable electronic devices: a randomised controlled study. European Journal of Preventative Cardiology, 22(11), 1368-1377.

Piotrowicz, E., Pencina, M., Opolski, G., Zaręba, W., Benach, M., Kowalik, I., . . . Piotrowicz, R. (2020). Effects of a 9-Week Hybrid Comprehensive Telerehabilitation Program on Long-term Outcomes in Patients With Heart Failure. JAMA Cardiology, 5(3), 300-308.

Pisano, G. P., Sadun, R., & Zanini, M. (2020, March 27). Lessons from Italy's Response to Coronavirus. Harvard Business Review. Retrieved from https://hbr.org/2020/03/lessons-from-italys-response-to-coronavirus

Plochg, T., & Klazinga, N. S. (2002). Community-based integrated care: myth or must?. International Journal for Quality in Health Care, 14(2), 91-101

Polese, F., & Carrubbo, L. (2016). Eco-sistemi di servizio in Sanità. Giappichelli.

Polese, f., Carrubbo, L., Caputo, F., & Sarno, D. (2018). Managing Healthcare Service Ecosystems: Abstracting a Sustainability-Based View from Hospitalization at Home (HaH) Practices. Sustainability, 10(11), 39-51.

Polese F, Carrubbo L, Caputo F, Sarno D. (2018) Managing Healthcare Service Ecosystems: Abstracting a Sustainability-Based View from Hospitalization at Home (HaH) Practices. Sustainability; 10(11):3951. https://doi.org/10.3390/su10113951

Polese, F., Mele, C. and Gummesson, E. (2014), "Addressing complexity and taking a systemic view in service research", Managing Service Quality: An International Journal, Vol. 24 No. 6. https://doi.org/10.1108/MSQ-09-2014-0201

Pollard, D. (2016). Strategies for mass customization. Journal of Business & Economics research , 101-110.

Porciuncula, F., Roto, A., Kumar, D., Davis, I., Roy, S., Walsh, C., & Awad, L. (2018). Wearable Movement Sensors for Rehabilitation: A Focused Review of Technological and Clinical Advances. PM&R, 10(9S2), S220-S232.

Prante, F., Bramucci, A., & Truger, A. (2020). Decenni di restrizioni alla spesa hanno lasciato il Sistema sanitario nazionale impreparato ad affrontare la crisi del Covid-19. La rivista delle Politiche Sociali.

Pristipino C. La medicina sistemica come metodo scientifico per la personalizzazione delle cure in cardiologia [Systems medicine as a scientific method for individualizing therapies in cardiology]. Monaldi Arch Chest Dis. 2012 Mar;78(1):3-5. Italian. doi: 10.4081/monaldi.2012.136. PMID: 22928396

Quaosar, A., Hoque, R., & Bao, Y. (2018). Investigating Factors Affecting Elderly's Intention to Use m-Health Services: An Empirical Study. Telemedicine and e-Health, 24(4).

Quattrociocchi, B., Iandolo, F., Fulco, I., Calabrese, M. (2018). Capitolo III. Efficienza, efficacia e sostenibilità. Il contributo dell'Approccio Sistemico Vitale (ASV) all'orientamento dei comportamenti d'impresa. In "Il Controllo Manageriale e gli Indicatori di Performance Dentro e Fuori le Organizzazioni: Alcuni Contributi di Studio". Edizioni Nuova Cultura.

Quattrociocchi, B., Calabrese, M., Iandolo, F., Mercuri, F. (2022). Industry Dynamics and Industry 4.0: Drones for Remote Sensing Applications. Taylor& Francis.

Realdon, O., Rossetto, F., Nalin, M., Baroni, I., Cabinio, M., Fioravanti, R., . . . Baglio, F. (2016). Technology-enhanced multi-domain at home continuum of care program with respect to usual care for people with cognitive impairment: the Ability-TelerehABILITation study protocol for a randomized controlled trial. BMC Psyachiatry, 16.

Ridolfi, L. (2011). Il Community care quale possibile modello di integrazione socio-sanitaria a livello territoriale. Espanet Conference "Innovare il welfare. Percorsi di trasformazione in Italia e in Europa".

Rogante, M., Grigioni, M., Cordella, D., & Giacomozzi, C. (2010). Ten years of telerehabilitation: A literature overview of technologies and clinical applications. NeuroRehabilitation, 27(4), 287-304.

Romàn, I., Calvillo, J., & Roa, L. M. (2009). Handbook of Digital Homecare. In In: Yogesan K., Bos L., Brett P., Gibbons M.C. (eds) Handbook of Digital Homecare. Series in Biomedical Engineering (pp. 33-52). Springer.

Rouse, W. B. (2008). Health Care as a Complex Adaptive System: Implications for Design and Management. The Bridge.

Runfola, M., Fantola, G., Pintus, S., Iafrancesco, M., & Moroni, R. (2020). Telemedicine Implementation on a Bariatric Outpatient Clinic During COVID-19 Pandemic in Italy: an Unexpected Hill-Start. Obesity Surgery, 30(12), 5145-5149.

Russel, T. (2007). Physical rehabilitation using telemedicine. Journal of telemedicine and telecare, 13(5), 217-220.

Russel, T., Hoffmann, T., nelson, M., Thompson, L., & Vincent, A. (2013). Internet-based physical assessment of people with Parkinson disease is accurate and reliable: a pilot study. Journal of rehabilitation research and development, 50(5), 643-650.

Ryan, A. A., & Scullion, H. F. (2000). Family and staff perceptions of the role of families in nursing homes. Journal of advanced nursing, 32(3), 626-634

Salcudean, S., Morandi, H., Black, D., & Navab, N. (2022). Robot-Assisted Medical Imaging: A Review. IEEE, 110, n.7, p. 951-967.

Sampson, S. E., & Froehle, C. M. (2009). Foundations and Implications of a Proposed Unified Services Theory. Production and operations management.

Santovito, S. & Iazzi, A. (2015). Digital innovation and business management. In "Innovative Management Perspectives on Confronting Contemporary Challenges". Cambridge Scholars Publishing.

Saviano, M. 2007. Un modello di analisi dell'efficacia delle relazioni tra azienda sanitaria e utenza: la Matrice delle Prestazioni Sanitarie. in Nigro, C., Saviano, M. and Merola, B. (Eds.). Il marketing relazionale nelle aziende sanitarie. ESI, Napoli.

Saviano, M., Bassano, C., & Calabrese, M. (2010). A VSA-SS Approach to Healthcare Service Systems the Triple Target of Efficiency, Effectiveness and Sustainability. Service Science, 2(1-2), 41-61.

Saviano, M. (2012). Condizioni di efficacia relazionale e di performance nelle aziende sanitarie. Giappichelli.

Saviano, M. (2014). Condizioni di efficacia relazionale e di performance nelle aziende sanitarie. Giappichelli.

Saviano, M., Bassano, C., Picciocchi, P., Di Nauta, P., & Lettieri, M. (2018). Monitoring Viability and Sustainability in Healthcare Organizations. Sustainability, 10(10), 3548.

Saviano, M. & Perillo, C. (2021a). From Hospital to Home: Service and Systems thinking for effective, efficient and sustainable healthcare. In: The 7th Naples Forum on Service

Proceedings Pag.1-2, The Naples Forum on Service 2021. Capri, Italy September 6-9 2021.

Saviano, M. & Perillo, C. (2021b). Exploring the systems thinking contribution to the modelling of Integrated Home Care. In: WOSC 2021 Book of abstracts Pag.171-172, Systems approach and cybernetics, engaging the future of mankind. The significance of systems and cybernetics in the future of societies. Moscow (on line) 27-30 September 2021

Saviano, M., Perillo, C., & Fumai, C. (2022). Unraveling the physical/digital dilemma in healthcare service systems in the light of a structure/systems view. The 17th International Research Symposium on Service Excellence in Management Valencia (p. 171-181). Valencia: Editorial Universitat Politècnica de València.

Sarfo, F., Ulasavets, U., Opare-Sem, O., & Ovbiangele, B. (2018). Tele-Rehabilitation after Stroke: An Updated Systematic Review of the Literature. Journal of Stroke.

Schaper, L., & Pervan, G. (2007). ICT & OTs: a model of information and communications technology acceptance and utilisation by occupational therapists. International Journal of Medical informatics, 76, S212-S221.

Schwamm, L., Chumbler, N., Brown, E., Fonarow, G., Berube, D., Nystrom, K., . . . Tiner, C. (2017). Recommendations for the Implementation of Telehealth in Cardiovascular and Stroke Care: A Policy Statement From the American Heart Association. Circulation, 135, 24-44.

Shahbaz, M., Gao, C., Zhai, L., Shahzad, F., & Hu, Y. (2019). Investigating the adoption of big data analytics in healthcare: the moderating role of resistance to change. Journal of Big Data, 6.

Sharifi, M., Behzadipuor, S., Salarieh, H., & Tavakoli, M. (2020). Assist-as-needed policy for movement therapy using telerobotics-mediated therapist supervision. Control Engineering Practice, 101.

Shaw S, Rosen R and Rumbold B (2011) An overview of integrated care in the NHS: What is integrated care? London: Nuffield Trust. http://www.nuffieldtrust.org.uk/sites/files/nuffield/publication/what_is_integrated_care_research_report_june11_0.pdf

Shortell, S.M., & Kaluzny, A.D. (1994). Health care management: Organization design and behavior. Delmar, Albany/New York.

Shukla, H., Nair, S., & Thakker, D. (2016). Role of telerehabilitation in patients following total knee arthroplasty: Evidence from a systematic literature review and meta-analysis. Journal of Telemedicine and Telecare, 23(2).

Siano, A., Piciocchi, P., Volpe, M., Confetto, M., Vollero, A. and Siglioccolo, M. (2012). A VSA communication model for service systems governance. In: Advancec in the Human Side of Service Engeneering.

Siano, A., Vollero, A., Della Volpe, M., Confetto, M.G., Foroudi, P. and Palazzo, M. (2018), "The role of physical metaphors for decision-making in integrated corporate communication", The Bottom Line, Vol. 31 No. 1, pp. 42-55.

Siano, A., Palazzo, M. (2021). Fifth-generation (5G) communication networks and sustainability: a research agenda. Corporate governance and research & development studies. (lo sviluppo reso possibile dai communication network)

Singh, G., Pal, U., Mishra, M., Gaur, A., Pathak, D., & Singh, Y. (2020). Teleassistance and teleconsultation using smartphones and its contribution in clinical progress of oral and maxillofacial surgery. National Journal of Maxillofacial Surgery.

Sidani, S., van Soeren, M., Hurlock-Chorostecki, C., S. R., Fox, M., & Collins, L. (2016). Health Professionals' and Patients' Perceptions of Patient-Centered Care: A Comparison. European Journal for Person Centered Healthcare, 4(4), 641-649.

Sivan, M., Gallagher, J., Makower, S., Keeling, D., Bhakta, B., O'Connor, R. J., & Levesley, M. (2014). Home-based Computer Assisted Arm Rehabilitation (hCAAR) robotic device for upper limb exercise after stroke: results of a feasibility study in home setting. Journal of NeuroEngineering and Rehabilitation, 11.

Small, H. (1973). Co-citation in the scientific literature: A new measure of the relationship between two documents. Journal of the American Society for Information Science.

Spohrer, J., & Kwan, S. K. (2008). Service Science, Management, Engineering, and Design (SSMED): Outline & References. The future of services: trends and perspectives, 107-232.

Syed-Adbul, S., Malwade, S., Nursetyo, A., & al., e. (2019). Virtual reality among the elderly: a usefulness and acceptance study from Taiwan. BMC Geriatrics, 19.

Tabak, M., Vollenbroek, M., Van Der Valk, P., Van Der Palen, J., & Hermens, H. (2013). A telerehabilitation intervention for patients with Chronic Obstructive Pulmonary Disease: a randomized controlled pilot trial. Clinical Rehabilitation, 28(6).

Talukder, S., Sorwar, G., Bao, Y., Ahmed, J., & Palash, A. (2020). Predicting antecedents of wearable healthcare technology acceptance by elderly: A combined SEM-Neural Network approach. Technological Forecasting and Social Change, 150.

Tanwani, A. K., & Calinon, S. (2017). A generative model for intention recognition and manipulation assistance in teleoperation. 2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), (p. 43-50). Vancouver, BC, Canada.

Taylor, S., & Todd, P. (1995). Understanding Information Technology Usage: A Test of Competing Models. Information Systems Research, 6(2), 144-176.

Taylor, C., & Dajani, L. (2008). The future of homecare systems in the context of the ubiquitous web and its related mobile technologies. In Proceedings of the 1st international conference on PErvasive Technologies Related to Assistive Environments (pp. 1-4)

Taylor, M., & Griffin, M. (2014). The use of gaming technology for rehabilitation in people with multiple sclerosis. Multiple Sclerosis Journal, 21(4).

Taylor, E., & Hignett, S. (2021). DEEP SCOPE: A Framework for Safe Healthcare Design. Int. J. Environ. Res. Public Health, 18(15), 7780.

Tavares, J., & Oliveira, T. (2016). Electronic Health Record Patient Portal Adoption by Health Care Consumers: An Acceptance Model and Survey. Journal of Medical Internet Research, 18(3).

Tchero, H., Tabue-Teguo, M., Lannuzel, A., & Rusch, E. (2018). Telerehabilitation for Stroke Survivors: Systematic Review and Meta-Analysis. Journal of Medical internet Research, 20(10).

Tenforde, A., Borgstrom, H., Polich, G., Steere, H., Davis, I., Cotton, K., . . . Silver, J. (2020). Outpatient Physical, Occupational, and Speech Therapy Synchronous Telemedicine A Survey Study of Patient Satisfaction with Virtual Visits During the COVID-19 Pandemic. American Journal of Physical Medicine & Rehabilitation, 99(11), 977-981.

Theodoros, D., Hill, A., & Russell, T. (2016). Clinical and Quality of Life Outcomes of Speech Treatment for Parkinson's Disease Delivered to the Home Via Telerehabilitation: A Noninferiority Randomized Controlled Trial. American Journal of Speech-Language Pathology.

Torbica, A., & Fattore, G. (2005). The “Essential Levels of Care” in Italy: when being explicit serves the devolution of powers. The European Journal of Health Economics, 6, 46-52.

Tousignant, M., Moffet, H., Boissy, P., Corriveau, H., Cabana, F., & Marquis, F. (2011). A randomized controlled trial of home telerehabilitation for post-knee arthroplasty. Journal of telemedicine and telecare, 17(4), 195-198.

Tousignant, M., Moffet, H., Nadeau, S., Mérette, C., Boissy, P., Corriveau, H., . . . Dimentberg, R. (2015). Cost Analysis of In-Home Telerehabilitation for Post-Knee Arthroplasty. Journal of Medical Internet Research, 17(3).

Tramonti, F., Giorgi, F., & Fanali, A. (2020). Systems thinking and the biopsychosocial approach: A multilevel framework for patient-centred care. Systems Research and Behavioral Science, 38(2), 215-230.

Timelli, L., & Girardi, E. (2021). Effect of timing of implementation of containment measures on Covid-19 epidemic. The case of the first wave in Italy. PLOS ONE.

Truter, P., Russell, T., & Fary, R. (2014). The Validity of Physical Therapy Assessment of Low Back Pain via Telerehabilitation in a Clinical Setting. Telemedicine and e-Health, 20(2).

Tung, F., Chang, S., & Chou, C. (2008). An extension of trust and TAM model with IDT in the adoption of the electronic logistics information system in HIS in the medical industry. Internationa Journal of Medical Informatics, 77(5), 324-335.

Tsai, C. (2014). Integrating Social Capital Theory, Social Cognitive Theory, and the Technology Acceptance Model to Explore a Behavioral Model of Telehealth Systems. Int. J. Environ. Res. Public Health, 11(5), 4905-4925.

Tsai, T., Lin, W., Chang, Y., Chang, P., & Lee, M. (2020). Technology anxiety and resistance to change behavioral study of a wearable cardiac warming system using an extended TAM for older adults. PLOS ONE.

Urquijo, V., Viñals, C., Mesa, A., Vidal, N., Roca, D., Giménez, M., & Conget, I. (2022). Characteristics of people with type 1 diabetes who use technology in their treatment and who use frequently the technical assistance teleconsultation service [Características de las personas con diabetes tipo 1 que utilizan tecnología en su tratamiento y . Endocrinologia, Diabetes y Nutricion.

Van Schaik, P., Bettany-Saltikov, J., & Warren, J. (2002). Clinical acceptance of a low-cost portable system for postural assessment. Behaviour & Information Technology, 21(1), 47-57.

Vargo, S. L., & Lusch, R. F. (2004). Evolving to a New Dominant Logic for Marketing. Journal of Marketing, 68(1), 1-17.

Vargo, S. L., & Lusch, R. F. (2008). Service-dominant logic: continuing the evolution. Journal of the Academy of Marketing Science, 36, 1-10.

Vaughan, N., Gabrys, B., & Dubey, V. (2016). An overview of self-adaptive technologies within virtual reality training. Computer Science Review, 22, 65-87.

Venkatesh, V., & Davis, F. (2000). A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies. Management Science, 46(2), 186-204.

Venkatesh, V., Morris, M., Davis, G., & Davis, F. (2003). User Acceptance of Information Technology: Toward a Unified View. MIS Quarterly, 27(3), 425-478.

Venkatesh, V., & Bala, H. (2008). Technology Acceptance Model 3 and a Research Agenda on Interventions. Decision Sciences, 39(2), 273-315.

Viers, B., Lightner, D., Rivera, M., & al., e. (2015). Efficiency, Satisfaction, and Costs for Remote Video Visits Following Radical Prostatectomy: A Randomized Controlled Trial. European Urology, 68(4), 729-735.

Vitacca, M., Montini, A., & Comini, L. (2018). How will telemedicine change clinical practice in chronic obstructive pulmonary disease? Therapeutic Advances in Respiratory Disease, 12.

Vitacca, M., Comini, L., Tabaglio, E., Platto, B., & Gazzi, L. (2019). Tele-Assisted Palliative Homecare for Advanced Chronic Obstructive Pulmonary Disease: A Feasibility Study. Journal of Palliative Medicine, 22(2), 173-178.

Wang, R. H., Sudhama, A., Begum, M., Huq, R., & Mihailidis, A. (2016). Robots to assist daily activities: views of older adults with Alzheimer's disease and their caregivers. International Psychogeriatrics, 29(1), 67-79.

Wang, H., Tao, D., Yu, N., & Qu, X. (2020). Understanding consumer acceptance of healthcare wearable devices: An integrated model of UTAUT and TTF. International Journal of Medical Informatics, 139.

Wainer, A., & Ingersoll, B. (2015). Increasing Access to an ASD Imitation Intervention Via a Telehealth Parent Training Program. Journal of Autism and Developmental Disorders, 45, 3877-3890.

Wehmeyer, M. L., & Little, T. D. (2013). 10 Self-determination. In The Oxford handbook of positive psychology and disability (Vol. 116). Oxford University Press.

Winters, J. (2002). Telerehabilitation research: emerging opportunities. Annual review of biomedical engineering, 4, 287-230.

Witt Udsen, F., Lilholt, P. H., Hejlesen, O. K., & Ehler, L. H. (2017). Subgroup analysis of telehealthcare for patients with chronic obstructive pulmonary disease: the cluster-

randomized Danish Telecare North Trial. ClinicoEconomics and Outcomes Research, 9, 391-401.

Wolf, S., Sahu, K., Bay, R., Buchanan, S., Reiss, A., Linder, S., . . . Alberts, J. (2015). The HAAPI (Home Arm Assistance Progression Initiative) Trial: A Novel Robotics Delivery Approach in Stroke Rehabilitation. Neurorehabilitation and Neural Repair, 29(10).

Wolfram, S. (2008). Complexity: 5 Questions. Automatic Press/VIP, ch. 24, Carlos Gershenson.

Wu, J., Wang, S., & Lin, L. (2007). Mobile computing acceptance factors in the healthcare industry: A structural equation model. International Journal of Medical informatics, 76(1), 66-77.

Xiong, L., Chng, C., Chui, C., Yu, P., & Li, Y. (2017). Shared control of a medical robot with haptic guidance. International Journal of Computer Assisted Radiology and Surgery volume, 12, 137-147.

Yarbrough, A. (2007). Technology acceptance among physicians. A new take ok TAM. Medical Care Research and Review, 64(6), 650-672.

Yan, L., Li, C., Chen, J., Miranda, J., Luo, R., Bettger, J., . . . Wu, Y. (2016). Prevention, management, and rehabilitation of stroke in low- and middle-income countries. eNeurologicalSci, 2, 21-30.

Yeroushalmi, S., Maloni, H., Costello, K., & Wallin, M. (2019). Telemedicine and multiple sclerosis: A comprehensive literature review. Journal of Telemedicine and Telecare, 26(7-8).

Zayyad, M., & Toycan, M. (2018). Factors affecting sustainable adoption of e-health technology in developing countries: an exploratory survey of Nigerian hospitals from the perspective of healthcare professionals. Peer J.

Zhang, L., Tong, H., Demirel, H., Duffy, V. G., Yih, Y., & Bidassie, B. (2015). A Practical Model of Value Co-creation in Healthcare Service. Procedia Manufacturing, 3, 200-207.

Zhang, M., Luo, M., Nie, R., & Zhang, Y. (2017). Technical attributes, health attribute, consumer attributes and their roles in adoption intention of healthcare wearable technology. International Journal of Medical Informatics, 108, 97-109.

Zhang, Y., Liu, C., Luo, S., Xie, Y., Liu, F., Li, X., & Zhou, Z. (2019). Factors Influencing Patients' Intentions to Use Diabetes Management Apps Based on an Extended

Unified Theory of Acceptance and Use of Technology Model: Web-Based Survey. Journal of Medical internet Research, 21(8).

Zhou, M., Zhao, L., Kong, N., Campy, K., Qu, S., & Wang, S. (2019). Factors influencing behavior intentions to telehealth by Chinese elderly: An extended TAM model. International Journal of Medical Informatics, 126, 118-127.

**Websites**

Italian Ministry of Health. (2019). National Health Service. Retrieved from Principles of the INHS: https://www.salute.gov.it/portale/lea/dettaglioContenutiLea.jsp?lingua=english&id=5073&area=Lea&menu=vuoto

Khymeia. https://khymeia.com/it/

Ministry of Health. (2019). Cosa sono i LEA. Retrieved from Servizio Sanitario Nazionale: i LEA: https://www.salute.gov.it/portale/lea/dettaglioContenutiLea.jsp?lingua=italiano&id=1300&area=Lea&menu=leaEssn

Ministry of Health. (2019). Assistenza ospedaliera. Retrieved from Servizio Sanitario Nazionale: i LEA: https://www.salute.gov.it/portale/lea/menuContenutoLea.jsp?lingua=italiano&area=Lea&menu=ospedaliera

Ministry of Health. (2019). Strengths of the Italian National Health Service. Retrieved from Healthcare in European Union: https://www.salute.gov.it/portale/cureUE/dettaglioContenutiCureUE.jsp?lingua=english&id=3879&area=cureUnioneEuropea&menu=vuoto

Nuova CTA. http://www.nuovacta.it/

Pharmanomics. pharmanomics.unisa.it

World Health Organization. (2019). Patient Safety. Retrieved from World Health Organization: https://www.who.int/news-room/fact-sheets/detail/patient-safety

**Rules and regulation**

Senato della Repubblica. (1947). Constitution of the Italian Republic.

Repubblica Italiana, Law 23 dicembre 1978, n. 833.

Repubblica Italiana, Law 3 agosto 2001, n.317.

Presidente del Consiglio dei Ministri, DPCM 29 novembre 2001.

Ministro della salute, Decreto 21 novembre 2005.

Presidente del Consiglio dei Ministri, DPCM 12 gennaio 2017.

Piano Nazionale di Ripresa e Resilienza, Governo Italiano, 2021.

# Acknowledgment

This chapter of my life is about to end and I would like to thanks the people that had a relevant role in my path. Goals are never achieved alone. These last three years have been full of new things, stimuli, and enthusiasm, representing a turning point in my human and academic formation.

At first I would like to thank the context of the **PhD Programm in Economics and Policy Analysis of Markets and Firms**. Thanks to **Prof.ssa Alessandra Amendola**, coordinator of the program, which support has been very valuable in these years, together with the offered growth opportunities.Thanks to **each member of the Faculty** for the stimuli provided. Thanks, also, to the **technical and amministrative staff.**

What I am particularly grateful for is that I had the opportunity to benefit of the possible scientific community involvement, thanks to the various moments of approaching the **Scientific Community of the Viable Systems Approach**. This happened directly and, perhaps above all, indirectly by receiving the valuable stimuli of **Prof. Sergio Barile** through the precious guidance of my supervisor **Prof.ssa Maria Luisa Saviano.**

My greatest thanks, indeed, goes to **Prof.ssa Maria Luisa Saviano**, that let me start developing the scientific approach and rigor.
Thank you for the trust you have placed in me, for giving me the opportunity to follow you over the years and for instilling in me the passion and enthusiasm for research, without which this work would not have seen the light, as well as the others produced in these years. Those same passion and enthusiasm that makes your eyes sparkle when we talk about research or a new frontier of knowledge. You are a great academic and human example.

I'd like to thank **Dr Carmine Fumai** for allowing me to run this research at his facility, **Dr Maria Infante**, and all the **Nuova CTA staff** for having created the best possible conditions to carry on this exploratory investigation and for being such engaged and value co-crating actors during this research path.

Thanks to **Prof.ssa Francesca Iandolo** and **Prof.ssa Enrica Iannuzzi**, external reviewers, for the positive evaluations of this work and for the relevant suggestions and directions for the further development of the study, which I will certainly make use of.

I cannot forget to thank **Prof. Francesco Caputo**, who, within the community of the Viable Systems Approach, for the various moments of fruitful confrontation on the topics covered by the study.

*Let me now shift to Italian to thank all my family (my granny can understand English, but she is for sure more confident in Italian) and my friends for always supporting me.*

Un immenso grazie va alla **mia famiglia**: chiassosa, curiosa, amorevole, impertinente e bellissima.

Al pezzo più importante del mio cuore: **mio fratello Francesco**. Non hai idea di quanto mi manchi. Ti amo infinitamente. Sei in ogni mio pensiero, in ogni mio gesto, in ogni mio momento. Sei la parte migliore di me. E sono tanto orgogliosa del giovane uomo che stai diventando.

A **mammà**, la donna più luminosa di questo universo. Per il tuo amore infinito, per la tua tenacia e la tua *resilienza*. Anche nei momenti difficili della vita. Perché la famiglia viene prima di tutto.

A **papà**, perché senza te non avrei intrapreso questo percorso. Per avermi "educata" alla curiosità, facendomi appassionare e stimolandomi al ragionamento, sempre. Sei la mia palestra più grande.

Alla mia meravigliosa (e insopportabile) **nonnina Lina**. Tu ancora teenager e io la più giovane dei tuoi figli. L'avresti mai detto che io avrei presentato il tuo primo libro di poesie e l'anno dopo tu avresti letto la mia tesi di dottorato?! E sì, il mio primo ricordo resta casa tua, con te immersa con la testa tra i libri a studiare e a scrivere. Forse è per questo che continuo sempre a studiare anche io.

A **zio Gianfy**, **zio Mario** e **zio Roby**, ventenni quando, da piccola mascotte, sono entrata nelle vostre vite. Sono cresciuta insieme a voi. Mi avete amato come fossi figlia vostra e mi avete trasmesso gioia e passione, tenacia e costanza, la capacità di ridere, la forza di inseguire le mie passioni e l'orgoglio di essere una Ferrandino.

Ai miei fantastici cuginetti: **Marianeve, Luigi, Alessandra, Martina, Ludovica e Ginevra**. **A voi e a Francesco** voglio augurare di raggiungere traguardi di gran lunga più grandi dei miei. Ci sarò sempre, a indicarvi la strada, sostenervi e amarvi con tutte le mie forze.

A **nonno Gigi**. Sei in ogni mio passo. La tua mano sempre sulla mia spalla.

A **Giuliano**, per ogni momento insieme. Tra una risata e un pensiero serio. Con te ho voglia di futuro… sì, sicuramente sei tu. A tutta la tua famiglia, che mi ha accolta con affetto.

A **Gianni**, che continua a osservare ogni mio passo.

A **Eduardo**, una roccia ed un cuore buono. Dopo le nuvole… la giornata di sole arriverà.

Ai cugini dell'asse Corso-Perillo, **Alfonso, Claudio e Maria Giovanna**, vi voglio un bene infinito. A **Nicola** e **Paola**, per esserci sempre.

A **zio Aldo**, a **nonno Franco** e **nonna Claudia**, che mi guardano da lassù.

Alle mie adorate zie: **Carletta**, **Maria**, **Annarita, Daniela e Laura**.

Ai **miei straordinari amici**: a **zio Pino**; a **Marta** e a **Giulia** "**Farandona**"; a **Carolina**; a **Giulia** "**Cicio**" e a **Nunzio**; a **Chiara** e **Gianmarco;** ad **Angelo**; a **Raffaele**; al maestro **Genny**; ad **Antonio.**; a **Isabella**; a **Marco**.

Ad **Antonio A.**, maestro e guida professionale. A **Francesco V**., **Uejda**, **Giovanna** e **Felicia**, **Salvatore** e **Marco**, ad **Antonio C**., a **Tonino**, a **Daniele** e ad **Attilio**, il mio "papà di fiera". A **Daniele** e **Raffaele**, compagni di questi ultimi anni di dottorato.

Agli amici di **ACE**, di **Led** e della **LUISS.**

A tutta la **SVAS,** arena e casa, casa e arena.

A tutti gli amici testimoni dei momenti importanti della mia vita.

A tutti voi devo dire grazie per avermi permesso di raggiungere questo traguardo. Sicura che sarete con me anche nelle prossime imprese. **Verso nuovi mari, nuovi orizzonti e nuove avventure!**

Salerno, 6/6/23

Claudia

**#beyonder**